United States

Department Of The Interior

Bureau Of Land Management

Region III

Missouri River Basin Investigations

DETAILED
LAND PLANNING AND CLASSIFICATION REPORT
as Relates to the Public Domain Lands
in the

WIND RIVER BASIN
(Wyoming)

(For Administrative Use Only)

June, 1949

This report was compiled in connection with the program of the Department of the Interior for the development of the resources of the Missouri River Basin.

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PREFACE

This report is presented as an integral part of the coordinated Missouri River Basin comprehensive resource development program being conducted by the agencies of the Department of the Interior concerned with land and water use. The report provides the basic information for the carrying out of a proper land use management program on public domain lands situated in Wind River Basin, Wyoming. The data presented are the results of a detailed three-year field study which was completed in July, 1948.

In the initial stages of this study an introductory or preliminary report was prepared and published in June, 1947, entitled "Land Planning and Classification Report for Boysen Area, Wyoming". The report sketches the settlement of the Wind River Basin; the physical, cultural and economic factors which have influenced its development; the major types of land tenure; the relationships of the public domain to these factors and problems attendant thereto. On the basis of these factors, recommendations were made for further detailed studies and investigations of the public domain.

Detailed studies were concurrently carried on and completed on the Badwater Sub-area, as proposed, which resulted in a second report, also published in June, 1947, entitled "Land Planning and Classification Report for Badwater Sub-area of the Boysen Area, Wyoming". This second report presented an analysis and detailed inventory of the public domain in the Badwater Creek watershed, its resources, uses, conditions, existing problems and proposals for their solution.

The present report presents a comprehensive and detailed description of all public domain in the Wind River Basin. It encompasses, therefore, pertinent factual information published in the Badwater report as well as information for all other public domain areas in the basin. While the report is complete in itself in so far as public domain lands are concerned, its value will be enhanced if supplemented with the preliminary "Boysen Area" for general information, or the "Badwater Sub-area" report for additional detailed information concerning public domain in the Badwater Creek watershed.

The report will provide the basic information for carrying out proper land use management and development programs on the public domain. It will provide basic data for integrating proper land use and promoting a higher economy in the report area. Although the public domain comprises a dominant portion of the report area, the program proposed cannot be fully effective unless it is coordinated and integrated with all related land and water use programs in the Wind River Basin.

Submitted June 30, 1949
By:

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Approved by:

A. D. Melohon,
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Billings, Montana

TABLE OF CONTENTS

Table of Contents
continued

INDEX OF TABLES

Table of Index Cont'd.

FIGURES AND MAPS

ACKNOWLEDGEMENT

Information for this report was gathered from many sources including published reports and documents and interviews with officials of various agencies. Among these agencies are: the Soil Conservation Service and Carter Oil Company for the loan of aerial photographs used for recordation of pertinent cartographic features; the various county assessors, U. S. Forest Service, Production and Marketing Administration, State of Wyoming and Bureau of Indian Affairs for furnishing information pertaining to land tenure and control; the County Extension Agents, Soil Conservation Service, Production and Marketing Administration, Forest Service and Bureau of Reclamation for providing data on land use, conservation, and development programs; the U. S. Geological Survey for contributions and reports pertaining to erosion and sedimentation problems; the Bureau of Mines and U. S. Weather Bureau for local climatological data. Credit is due to the many ranchers who provided data on ranch operations.

Detailed field surveys and investigations were made of the report area during the years 1946 through 1948 by members of the Division of Planning staff of Region III, Bureau of Land Management, Billings, Montana, in cooperation with personnel of the Wind River Grazing District stationed at Lander, Wyoming.

Field work was supervised by Fred M. Benson, Range Examiner, who was also in charge of the assembly and compilation of the factual data, including map manuscripts.

Editing and synthesis, into a single consolidated report of the manuscript reports and maps for the Muskrat-Lander and Dubois Sub-areas with that of the Badwater Sub-area report published in June, 1947, was under the direction of Harold T. Tysk, Land Economist. Analysis and review of the consolidated report was the joint undertaking of R. D. Nielson, Chief, Division of Planning, Harold T. Tysk, Land Economist, Fred M. Benson, Range Examiner, L. R. Brooks, Range Manager and Ed Hill, Assistant Range Manager. The maps and charts, which form a part of this report, were prepared in the Billings drafting office under the supervision of William C. Anderson, Engineering Draftsman.

The study in all its aspects was under the general supervision of R. D. Nielson, Chief, Division of Planning, Region III, Bureau of Land Management, Billings, Montana.

PURPOSE and SCOPE

This report presents a detailed analysis of the public domain, its present development, utilization and condition, its problems and needs and the interrelationship of the resources of the public domain with other resources in the overall economy of the Wind River Basin. This report is the third in a series of reports for the Wind River Basin, the first of which was published in June 1947. The introductory report presented a preliminary analysis of the physical and economic features of the Wind River Basin as they relate to the projected Boysen Reservoir. The introductory report served as a guide in orienting the detailed land classification and planning activities of the Bureau of Land Management and served as a step in the furtherance of the overall Missouri River Basin Development Program. It served to direct attention to the broad land use and land management problems prevailing in the area as a whole and thus served as a logical base for the detailed studies which followed.

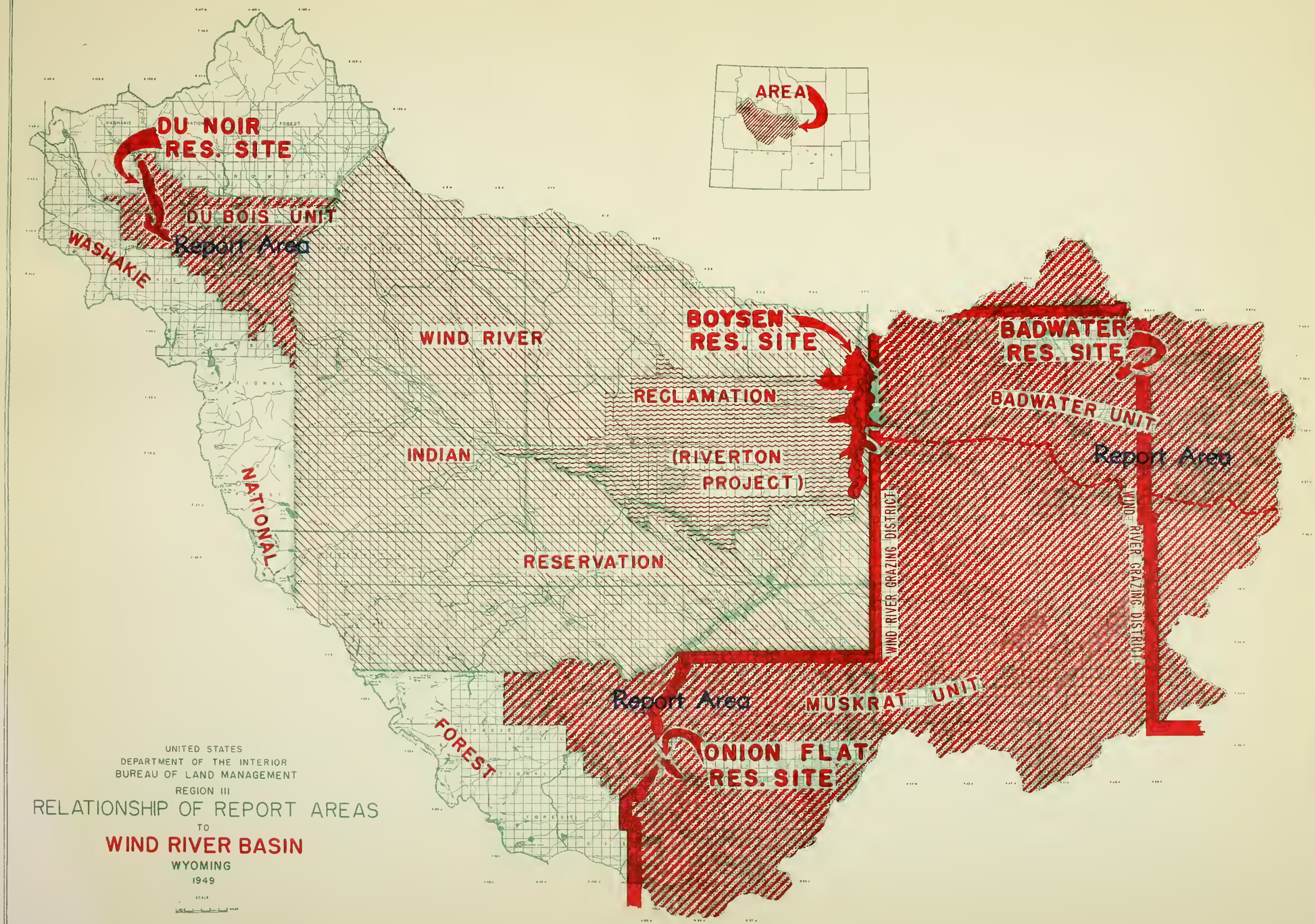
A detailed report published in June, 1947, which covered the Badwater Drainage of the Wind River Basin, presented a detailed inventory and an analysis of the problems for that area relative to the public domain lands.

In furtherance of the comprehensive resource and development study of the Wind River Basin being conducted by all agencies of the Department of Interior concerned with land and water use, the present report endeavors to present a comprehensive study of all of the public domain resources within this basin. The consolidated report, therefore, presents factual information regarding the amount and condition of the resources of the public domain area in the Wind River Basin, the problems of the report area, with proposed treatments and improvements. Economic and resource import of integrated use of grazing and farm lands is also presented as well as proposals for the realization of these benefits. The report is planned to serve as basic factual reference material for the development of plans and for the conduct of operational and conservation activities within the areas described. The area covered by this report is shown on the location map opposite page III. Information compiled in this report will be of use to operators, planners and administrators of land and its use in the basin. It is hoped that the description of the resources of the area and the presentation of inherent problems and proposals for their correction, will aid in the integration of irrigated and range land use for the mutual advancement of the basin's economic and social well-being.

The paramount concern is to present ways and means of securing the most beneficial use of the soil and water resources of the public domain. The vast area of range land of which the public domain comprise so large a part will always be a major base of the basin's economy. Upon the proper use of these range lands hinges the success or failure of irrigation facilities and other developments in the Wind River Basin. The construction of Boysen Dam for power, irrigation water supply, desilting, stream flow regulation and flood control at the mouth of Wind River Basin emphasizes the need to control the production of silt within the report area in order to preserve the expensive and valuable storage capacity of this reservoir. The control of silt and sedimentation is of no less importance for other tributary drainages within the Wind River Basin as well.

Scope of this report includes all of the public domain lands which are administered by the Bureau of Land Management in the Wind River Basin. As shown on the map accompanying this report, the areas considered are located in two blocks separated by the Wind River Indian Reservation and the Shoshone National Forest. Field inventories of land resources included lands in all types of ownership in the larger block embracing the southern and eastern portion of the Wind River Basin where public domain comprises 64 percent of all classes of land ownership. In the western portion, the Dubois area, only the public domain was inventoried because public domain comprises but 25 percent of the area. Factual resource data as well as problems and improvements are shown on the five maps which accompany this report. The base of all these maps shows the drainages, cultural features, public survey grids, counties, existing improvements and status of land ownership. Map No. 1 shows the vegetative type of range plant cover with a density and forage acre factor for each type. Map No. 2 describes proposed improvements as remedial to the problems presented herein together with the erosion conditions for the report area. Map No. 3 portrays the land-use capability together with its condition class. Map No. 4 depicts the present land tenure and operating units as of 1948 and Map No. 5 shows the land-use suitability and proposed adjustments in land tenure. The 21 tables in the report presents statistics of factual information regarding the report area as outlined in the table of contents.

Lands within these two blocks do not constitute an independent economic area as many of the operators therein also utilize lands on the National Forest, Indian Reservation and the Riverton Irrigation project as well as other lands outside of the basin. This report, therefore, should be considered in conjunction with its predecessor, the land planning and classification report for the Boysen area, Wyoming, published by the Bureau of Land Management, Region III, Billings, Montana in June, 1947.



UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
REGION III

RELATIONSHIP OF REPORT AREAS
TO
WIND RIVER BASIN
WYOMING
1949

SUMMARY

Widespread emphasis is placed on conservation management and development of the public domain in the pages which follow. Comprising, as it does, more than 26 percent of the entire Wind River Basin and 61 percent of the report area, the public domain naturally not only has a marked impact upon the present economy of the basin but will have its effect, adverse or beneficial, upon any future land or water resource developments and resulting economy which might take place. The proposed conservation practices are those which will promote the welfare of the basin's economy. The various regulatory laws under which the Bureau of Land Management operates were conceived for the purpose of protecting, improving and perpetuating the basin's, and thus the nation's, basic resources, land and water. Toward this objective the report is devoted.

The substance of the report is essentially contained in the twenty-one tables and the five accompanying maps and in the "Problem" section of the supporting narrative.

The principal economic value of the surface resources of the public domain in the report area is that of grazing.

Map No. 1, Vegetation Type, illustrates, by aspect, the thirteen major types in the report area 1/. Each major type is described by a designation which portrays the primary vegetative species making up the local vegetation. Vegetative density and grazing capacity factors are described below each type designation. On the basis of aspect, sagebrush dominates in 87 percent of the area, grassland 4 percent, woodland and forest 4 percent and lesser types the remaining 5 percent. The average surface acre requirement per animal unit month for grazing on range lands classified is 6.39 acres. The total grazing capacity of the public domain is estimated at 196,455 animal unit months. Related state and private range lands in the report area have an estimated grazing capacity of 125,403 animal unit months. Tables 3 to 8 inclusive summarizes the vegetative resources and related data pertaining to its condition and use. Proper stocking and judicious use of the range during critical spring periods are the principal means by which vegetative cover can be improved.

Map No. 2, Erosion Condition and Proposed Improvements, delineates by location and degree, the relative severity of sheet, wind and gully erosion and indicates by location, the types of rehabilitation measures urgently needed to alleviate or remedy the problems resulting therefrom and which are not amenable to full correction through management alone. To retard accelerated erosion and to minimize as much as is economically feasible the geologic erosion on public domain lands is a primary objective of the Bureau of Land Management. Tables 10 to 14 inclusive, provide factual data pertaining to the qualitative and quantitative appraisal of public land watershed

1/ Methods and standards used are described in detail in "Interagency Instructions for Range Surveys" of April, 1937.

conditions and needs.

Map No. 3, Land-Use Capability, delineates the lands within the report area according to their physical use capability, utility and productivity as limited by such factors as topography, slope, soils, climate, drainage and other site considerations. It delineates the lands according to their long-time ability to produce and describes the conditions of the land resources within each such zone. Criteria for the classes or grades of land-use capabilities are expressed in terms of their highest return under a permanent system of management. Eight classes of land according to use capability from the physical standpoint have been recognized and are defined in Table II in the appendix 1/. Briefly, Classes I-IV are suitable for cultivation; Classes V-VII are not suitable for cultivation but suitable for permanent vegetation with grazing or woodland use; Class VIII, not suitable for usable vegetation or only suitable for watershed, wildlife or recreational purposes. These classes of land-use capability are developed by weighing and interpreting the physical factors influencing land-use, including the soil, topography, slope, kind and degree of erosion, vegetation, together with the most important features of environment, climate, drainage, and biological activity. The present land-use is not necessarily taken into account in the development of classes of land-use capabilities but it is used in developing management plans for the lands. Tables 8 and 9 summarize the pertinent features of classes of land according to their use capabilities and resource conditions.

Map No. 4, Present Land Tenure and Operating Unit, portrays the pattern of land ownership and control within the report area with particular emphasis placed upon the relationship between grazing use on the public domain with that of private and state lands. Table IV identifies by map index reference the 255 federal range allottees and public domain lessees in the report area.

Map No. 5, Land-Use Suitability and Proposed Land Ownership Adjustment, depicts the four major land-use suitabilities namely: lands primarily suitable for cultivation; land primarily suitable for forest and watershed; lands primarily suitable for grazing and watershed; and lands primarily valuable for watershed, wildlife and recreation. Best land-use is achieved when the balance between natural resources is such that a desirable standard of economy is possible without depleting or wasting the soil, water and biotic resources. Significant in the report area is the problem of properly integrating the use of the public domain lands, particularly the grazing resources, with that of other land resources and uses in the basin. The development of additional irrigated cropland primarily suitable for forage production will result in greater demands for range use. The long-range comprehensive resource development program will result in an increased population and a consequent increase in the demand for recreational and wildlife uses and watershed values will take on added significance.

1/ With slight modifications, the procedures used for classification are essentially the same as those described in U. S. Department of Agriculture Miscellaneous Publication 352, 1939, Soil Conservation Survey Handbook.

The problems resulting will be of considerable magnitude, complexity and variety and will affect plans for the future management, development and improvement of the public domain lands.

The proposed improvements and adjustments shown on the maps are those which will be in the public interest. Developing such improvements and effectuating such adjustments will be conditioned in large measure upon the coordinated efforts of all parties interested in the fullest development of the Wind River Basin's economy, the benefits of which will spread downward throughout the basin of the Missouri and into the economic and social stream of national activity.

LOCATION and SIZE

The public domain lands described in this report are located in two separate portions of the Wind River Basin in central and west-central Wyoming. As illustrated in Figure 1, opposite page III, both areas lie tributary to the Boysen Dam now under construction.

The western segment, described hereafter as the Dubois area, embraces a total area of 160,741 acres of which 41,113 acres, or only 26 percent, is public domain. Situated in Fremont County near the headwaters of the Wind River, it is surrounded on three sides by the Shoshone National Forest and to the east by the Wind River Indian Reservation.

The eastern part of the report area occupies parts of Fremont, Natrona and Hot Springs Counties and of the two segments is by far the largest, embracing a gross area of 1,926,635 acres of which 1,231,830 acres, or 64 percent is public domain or withdrawn lands administered by the Bureau of Land Management.

The two segments occupy a total area of 2,087,376 acres of which 1,272,943 acres, or 61 percent, are under the administration of the Bureau of Land Management.

An administrative unit of the Bureau of Land Management, the Wind River Grazing District (Wyoming Grazing District No. 2) occupies the largest part of the eastern segment of the report area and embraces 1,472,466 acres of which 1,065,361 acres are federal range and 407,105 acres are private or state lands, all in Fremont County. Fifty-seven percent of the gross area of the grazing district is included within the report area.

Table 1 shows the location and extent of land areas by classes of ownership and by counties within the report area. Table 2 depicts land areas by classes of ownership and by segments of the report area.

Table 1. - Classification of land ownership: acreage by counties within the report area of the Wind River Basin, Wyoming, 1948 1/

Class of ownership	Fremont County: Within Grazing District #2 2/ (acres)	Fremont County: Outside Grazing District #2 (acres)	Fremont County: Total area County (acres)	Natrona County (acres)	Hot Springs County 3/ (acres)	Total Outside Grazing District #2 (acres)	Total Report Area (acres)	Total Report Area (percent)
Federal Lands:								
Unreserved Public Domain	938,276	67,331	1,005,607	121,785	3,000	192,116	1,130,392	54.2
Withdrawn Lands:								
Stock driveway	115,792	840	116,632	12,846	-	13,686	129,478	6.2
Power site	2,323	-	2,323	-	-	-	2,323	.1
Public water reserve	999	460	1,459	-	-	460	1,459	.1
Reclamation	7,971	-	7,971	-	-	-	7,971	.4
Target range	-	1,320	1,320	-	-	1,320	1,320	--
Total Federal Lands	1,065,361	69,951	1,135,312	134,631	3,000	207,582	1,272,943	61.0
State of Wyoming	128,574	36,965	165,539	24,871	4,010	65,846	194,420	9.3
Private	278,531	170,510	449,041	137,447	33,525	341,482	620,013	29.7
Total State & Private	407,105	207,475	614,580	162,318	37,535	407,328	814,433	39.0
Total, all classes	1,472,466	277,426	1,749,892	296,949	40,535	614,910	2,087,376	100.0

1/ Bureau of Land Management, Region III, Billings, Montana; compiled from Bureau of Land Management records and official State of Wyoming and County records. The report area includes all lands in the Wind River Basin except those within the boundaries of the Wind River Indian Reservation or within the National Forest. The report area includes the Wind River Grazing District (Wyoming Grazing District #2) and areas adjacent thereto in the basin east and south of the reservation exclusive of the National Forest and the area around Dubois which is not within the National Forest. See Location Map facing page III.

2/ All of Wyoming Grazing District #2 (Wind River Grazing District) within the basin is in Fremont County, so this column is also a total for grazing district lands in the report area.

3/ Hot Springs County area is within the administrative area of Wyoming Grazing District No. 1 at Worland, Wyoming. Field administration for the area is performed by Wyoming District #2.

Table 2.- Land areas by classes of ownership and by segments of the report area, Wind River Basin, Wyoming, 1948 1/

Class of ownership	Area east and south of Wind River Indian Reservation		Dubois area west of Wind River Indian Reservation		Total Report Area	
	(acres)	(percent)	(acres)	(percent)	(acres)	(percent)
Federal Lands:						
Inside Wind River Grazing District	1,065,361	51.0	-	-	1,065,361	51.0
Outside Wind River Grazing District	166,469	8.0	41,113	2.0	207,582	10.0
Total Federal Lands	1,231,830	59.0	41,113	2.0	1,272,943	61.0
State and Private Lands:						
Inside Wind River Grazing District	407,105	19.5	-	-	407,105	19.5
Outside Wind River Grazing District	287,700	13.8	119,628	5.7	407,328	19.5
Total State and Private lands	694,805	33.3	119,628	5.7	814,433	39.0
Gross area, land in all ownerships:						
Inside Wind River Grazing District	1,472,466	70.5	-	-	1,472,466	70.5
Outside Wind River Grazing District	454,169	21.8	160,741	7.7	614,910	29.5
Total gross area	1,926,635	92.3	160,741	7.7	2,087,376	100.0

1/ Bureau of Land Management, Region III, Billings, Montana; compiled from Bureau of Land Management records and from State of Wyoming and County records.

PHYSIOGRAPHY

Topography of the report area varies from flat river flood plains with terraces and benches to rolling and rough hills and mountains. The eastern portion of the report area is bounded on the north by the crest of the Copper Mountains and the southern extremity of the Big Horn Mountains, 7,000 to 8,000 feet in elevation. The eastern boundary adjoins the watershed of Powder River and extends southward along this divide to the low Rattlesnake Range. The Rattlesnake Range and the steep Beaver Rim form the southern divide which extends southwestward to the Continental Divide in the Wind River Mountains. Beaver Rim forms a prominent break and barrier demarking the area from the Sweetwater drainage to the south. From the summit of the Wind River Mountains at Miner's Delight the boundary follows the Washakie National Forest northwestward to the Wind River Indian Reservation. The reservation line is followed eastward and northward to the Copper Mountains. The western Dubois report area, enclosed on three sides by the Shoshone National Forest at the base of the Wind River and Absaroka Mountains, forms a high basin plateau.

The report area is largely a rolling plateau, the floor of Wind River Basin forming an extension of the Great Plains. High mountains surround the area except on the southeast. The striking Wind River Mountains rise steeply south of the Dubois area to the Continental Divide with towering peaks ranging to Wyoming's highest, Gannett Peak, 13,785 feet in elevation. High on the Wind River slopes are the largest living glaciers in the 48 states and hundreds of glacial lakes. These mountains are a geographical and geological wonderland as well as a sportsman's paradise. The high mountains shelter the plateau floor to an extent unusual at this altitude, so much so that the report area has long been favored for grazing use. The rolling plateau floor is dissected with many water courses and is dotted with numerous buttes, mesas and badlands which offer additional protection for livestock.

Topography of most of the basin floor limits its use to grazing as it is too steeply rolling for farming purposes, particularly irrigation farming. The mountains surrounding the area are so high in elevation and are so rough in topography that they are restricted to grazing, timber, watershed, recreation and wildlife use. Much of the higher mountain range areas are useful only for short summer grazing periods. A considerable portion is so rough or heavily timbered that it cannot be utilized for grazing. The Wind River Mountain glaciers and snow fields make valuable contributions to the summer water supply for irrigation and other uses in the basin and downstream in the Big Horn, Yellowstone and Missouri Rivers. Terrain of the basin offers a number of sites for water storage and power development. Elevations vary from 4,608 feet in the Wind River Canyon at the north boundary of the basin to the mountain peaks in the Wind River Range in excess of 13,000 feet. The majority of the rolling plateau of the valley floor varies in elevation from 4,950 feet along the lower Wind River to 6,917 feet in the vicinity of Dubois.

Two principal stream drainages, the Wind and Popo Agie Rivers, join to flow through Wind River Canyon, forming the headwaters of the Big Horn River, a principal tributary of the Yellowstone River. Larger streams have

considerable valley bottom lands with adjacent benches which are used for irrigated crop production. Majority of the basin floor is gently to steeply rolling, only a relatively small portion of the area being sufficiently level to be well suited to irrigation. About 336,000 acres or 7 percent of the basin area is considered to be irrigable. The relative economic importance of this irrigable area and its potential value far exceeds that of forest and range lands, both per acre and in total. The range lands and farm lands are interdependent, however, as the best use of each type of land will result in benefits to both.

CLIMATE

Climate of the report area is considered to be arid and continental in type, except in the higher mountains. Precipitation is low, irregular, relatively undependable and is often highly localized. Most of the precipitation falls during the growing season from April through October with small amounts from November through March. Average annual precipitation for stations on the floor of the basin within, or adjacent to the report area, is less than 10 inches, ranging from 7.62 inches at Shoshoni to 9.81 inches at Riverton. The average annual precipitation increases with elevation progressively advancing to nearly 11 inches at Fort Washakie and over 18 inches at Middle Fork, which is 6,275 feet in elevation in the Wind River Mountains. Total precipitation probably exceeds 40 inches high in the Wind River Mountains near Dubois, considering the presence of large snow fields and glaciers. Analysis of the records of the eight weather stations in or adjacent to the area reveals a mean annual precipitation of 10.95 inches with a monthly mean range varying from 0.36 inches in December to 1.93 inches in May. Monthly and annual average precipitation for stations in the area is given in Table 15 of the appendix.

Range of precipitation annually and in any one month varies greatly at stations in the area, precipitation being much more dependable and regular at the higher elevations. While the majority of the precipitation usually falls during the summer months, some years very little rain falls during the summer months, there being a prolonged drought. Such a year was experienced in 1948. Annual precipitation has varied from 4.73 inches to 12.96 inches at Shoshoni; Riverton station has varied from 6.05 inches to 18.43 inches and the Dubois station from 5.47 inches to 15.88 inches.

Two of the worst floods on record in the report area occurred in 1923. The first storm washed out 20 miles of C. B. and Q. railroad track, three steel bridges, several buildings and ten freight cars. The channel of Badwater Creek was widened from 80 feet to 500 feet; loss to the railroad was estimated to be in excess of one million dollars. Two months later another storm of even greater intensity but covering a smaller area in the Badwater drainage, created another flood which washed out a considerable amount of the replaced railroad track. While such storm damage is infrequent, it serves to demonstrate potential extremes and serves as a warning of the erosion and flood hazards and the possibilities of abnormal silt production in the basin.

Depth and time of snowfall varies widely according to elevation and years. Usually the floor of the basin is free from snow or virtually so during the winter months. The extreme western portion of the basin from a point near Dubois and at higher elevations, is frequently snow covered and this snow cover occasionally extends eastward to the western boundary of the Wind River Reservation. Snow depth at Forest Service courses is shown in Table 21 in the appendix.

Climate of the report area is featured by relatively mild open winters considering the elevation and location. The high elevation also causes comparatively cool short summers. Spring weather tends to be cool and uncertain. Fall is relatively warmer with short, warm days and long cold nights. As would be expected with an arid climate, temperature contrasts with the bright days and the nights are considerable. There is a large proportion of sunshine with little cloudiness and quite moderate frequent winds especially in the springtime.

The average annual temperature for the weather stations is 43 degrees Fahrenheit, varying from 19 degrees in January to 69 degrees in July. Temperatures at the stations in higher elevations tend to be warmer in the winter and cooler in the summer due to the tempering effect of altitude in summer and air drainage in the winter months. Monthly and annual average temperatures for the eight stations in the area are given in Table 16 in the appendix.

Probably one of the best measures of climatic capability for livestock feed production, especially for hay and range plants is expressed in heat units. This measurement of climate considers 43 degrees Fahrenheit to be the critical temperature above which plant growth takes place. This figure is deducted from average monthly temperatures, the subtrahends being multiplied by the number of days in the month. Total average heat units for the eight basin stations is 2,833, varying from 1,686 at Dubois to 3,831 at Shoshoni. The monthly average varies from 18 in April to 794 in July. Heat unit data indicates that Shoshoni has the greatest potential of production as regards temperature in the area. Dubois on the other hand has the lowest potential of the stations of record. Heat units for the eight stations in the basin and their averages are shown in Table 18.

Prevailing winds in the Wind River Basin are from the southwest; wind is frequent but usually only mild in intensity. Occasionally gales are experienced, rarely accompanied by snow. The relative humidity of the report area definitely places it in the arid category. Recordings at the Lander station are probably higher than the balance of the basin floor owing to its location in the center of a large irrigated area and also due to its close proximity to the mountains. The average annual relative humidity here is 72 percent at 8:00 AM, 48 percent at noon and 47 percent at 8:00 PM. The lowest in July is 66 percent at 8:00 AM falling to 35 percent at noon and 31 percent at 8:00 PM. The highest relative humidity occurs in December, the average highest being 77 percent at 8:00 AM, 63 percent at noon and 65 percent at 8:00 PM. The clear, dry climate, low humidity and frequent wind combine to cause a high evaporation rate considering the elevation. Average annual evaporation on the floor of the basin is considered to be 42 inches.

Data on growing season is shown on Table 17 of the appendix.

Effects of Climate

Geographical, climatic and physiographical conditions of the Wind River Basin largely limits land use to grazing and the production of livestock feed under irrigation. The small volume and irregularity of the precipitation combines with a relatively low efficiency of precipitation and long periods of drought to produce a scattered vegetative cover of low density and volume. This scant cover leaves much of the soil surface exposed, so that the soil is vulnerable to erosion especially with heavy precipitation which occasionally causes localized flood conditions.

Climatic conditions have limited or prevented soil formation on some rough slopes and on fine clay parent material. Such areas are evidenced in badlands, scab areas, rocky slopes and clay peaks. Climatic effects on much of the shale parent material in the area produces shallow residual soils with low permeability and poor drainage.

Period of snow cover at elevations from 6,000 to 7,500 feet varies greatly. In some years ranges at this altitude may be used until Christmas while in other seasons they may be covered with snow in September and can not be used again until late spring. Winter snowfalls and accumulations on the floor of the valley are rare but they do occur occasionally, interfering with grazing, and making it difficult to get supplementary feed to livestock. March and April are the months of greatest snowfall. Occasionally snow falls in spring or early summer after sheep have been shorn, causing heavy losses. In April 1945, 33 inches of snow fell which made it impossible for sheep to graze and prevented the use of supplemental feed. Another heavy snow storm, which occurred on June 11 and 12, 1947, caused heavy losses to livestock. Snow accumulations increase in depth and period of duration directly in proportion with increases in elevation. This increase consumates with the prominent glaciers and snow fields at the peaks of the Wind River range. These snow accumulations, a greater part of which are located on the adjacent National Forest, are the most important water source furnishing summer run-off water to streams in the report area. Snow packs at the higher elevations restrict grazing use to relatively short summer periods.

Length of the growing season is not very dependable and makes the production of frost-tender crops hazardous. Since frost may be expected any month of the year, it is necessary to regard the production of beans and other frost susceptible crops as distinctly risky. The heavy production of beans at the lower elevations in the basin, particularly on the Riverton project during 1941 to 1948, can only be regarded as occurring during a period of years favored with unusually long growing seasons.

The climate of the study area is considered to be very favorable for grazing utilization in comparison with other areas of similar elevation in the Rocky Mountains. This condition is due to the protection afforded by the surrounding mountains which shelter the area from much wind and many severe storms. The eastern portion of the area is highly regarded for winter grazing. This area has also been noted for the earliness of its grass in the springtime. In spite of these notable advantages, however, the elevation and mountainous location mean that the entire area is occasionally susceptible to unseasonable frost and sudden and severe storms.

SOILS

No intensive soil surveys have been made on the area. Extensive reconnaissance shows that soils in the eastern portion of the area are Sierozem or gray desert soils of the Navajo-Chipeta areas formed under arid conditions. In the Dubois area soils are mostly Lithosols and shallow soils of the Underwood-Babb areas 1/. Most of the soils in the area are residual soils derived from the parent Wind River formation which is an irregular mixture of sandstones and shales interbedded with siltstones. These residual soils frequently lack depth, varying from a few inches to three feet deep. Alluvial soils are found along the water courses and on portions of the upland which are old water courses. The alluvial soils are usually deep with wide variations and irregularities in other characteristics. Variations in the surface parent material are principally responsible for differences in soil texture of the residual soils, the sandstones producing the sandy soils which predominate along Poison Creek, including active sand dunes southwest of Moneta. Soil textures range from fine, tight clays to coarse gravel and are irregularly distributed over the area.

Permeability or infiltration by moisture of basin soils is restricted principally by texture, also by slope and by chemical composition of the soil. Infiltration conditions vary from gravels capable of absorbing and draining any amount of precipitation as rapidly as it falls, to fine textured saline slick spots which are virtually incapable of absorbing any precipitation which may fall or accumulate on the surface. Large areas of soil are so fine in texture and are so combined with excessive quantities of salts and colloidal materials which tend to further disperse their particles that they can absorb moisture only in small amounts and at a very slow rate. These tight soils tend to promote run-off to an unusual degree and it is impractical to drain them. The restricted amount of moisture which is released to plants on such sites makes it difficult for plants to grow and only a narrow range of plant species are capable of occupying such sites. Between these extremes of soil texture and chemical compositions are areas of soil of good texture and structure classed as sandy loams which are well suited to irrigation agriculture.

The soils are highly calcareous with a low content of organic matter and nitrogen. Soluble salts are present in moderate to high concentrations, especially in the finer textured soils and in areas where run-off water concentrates. Seepage and concentration of salts are common on irrigated lands. Internal drainage is a problem on many of the soils. These soils are very little leached and are high in mineral plant nutrients. Under irrigation these soils are highly productive of adaptable crops where drainage is feasible. Conservative use of irrigation water with good management is essential.

The desert soils are naturally subject to rapid erosion. Vegetative soil cover on nearly half of the area is pedestaled, and on 10 percent of the area, the soil surface between the pedestals surrounding the clumps of vegetation is pavemented because of water or wind erosion. Control of grazing and reestablishment of vegetation are necessary to reduce destructive erosion on range lands.

1/ U. S. Department of Agriculture, Soils and Men, Yearbook, 1938

Soils in the mountains are derived principally from pre-Cambrian granite and metamorphic rocks which form the core of the surrounding mountains. Here the main soil type is clay loam, with small tracts ranging in texture from silt loam to fine gravel. Soils derived from sporadic out-crops of shale, sandstone, and limestone parent materials occur on the mountain slopes. On the Chugwater group of sedimentaries close to the mountains, red shallow loam soils of the Chugwater series obtain where soil development has occurred. In the Bridger Creek saddle on parent materials of the extensive outlying remnant of the Wind River formation, soils similar to the loam soils of the lower plateau area obtain. These soils are very subject to wind and water erosion. Diverse soils, with textures ranging from clay to fine gravel, developed from shales, sandstones, limestones, and weaker rocks such as claystones and siltstones, occur quite extensively on the lower mountain slopes.

On the rolling topography of the weakly bedded Wind River formation portion of the basin plateau, shallow, often stony, sandy loam to sandy clay loam soils prevail. The sandstones have weathered into sandy soils and the associated sandy claystones, clayey sandstones, and siltstones into finer textured clayey or silty soils. On all the sandstone uplands of the Wind River formation, the soils generally resenble the Saddle series mapped in the Shoshone Basin and possess a typically grayish-brown surface crust and mulch, light brown top-soil, and grayish-brown sub-soil. In general, the soils derived from claystones and siltstones are most susceptible to water erosion, although soils which have developed from intermixtures of both claystone or siltstone and sandstone are also quite vulnerable. The more sandy and shallow types tend to blow, if exposed. An intensive soil survey would probably reveal some very significant differences between soils on the Lost Cabin and Lysite members of the Wind River formation.

On the gravelly and cobbly interstream terraces on the lower foothill slopes north of Badwater Creek, gravelly and stony loam soils occur. On first bottomlands along the streams where high water stages cause flooding and deposition of a variety of alluvial materials darker colored and heavier soils occur which support brush, open grass, meadows, cultivated hay crops, or groves of cottonwood trees. On recent alluvial terraces near the streams, silt loams and heavier soils are prevalent.

Soils in the Dubois area are principally gravelly or rocky, most of them being derived from gravel terrace and bench formations. There is an extensive badlands area along the north side of Wind River east and west of Dubois covering nearly 10,000 acres. On these badlands active geologic erosion of the steeply sloping clay is more rapid than soil formation. This area is a serious problem because of its silt contribution.

Isolated clay peaks with steep slopes virtually lacking in soil or vegetation are scattered between Beaver and Poison Creeks in the south-eastern part of the area. Bench and terrace lands of the Wind River-Otero soil series make up much of this region. Soils near the Beaver Rim are rough and rocky and of clay texture.

The irrigated farm lands are nearly all located on the deep alluvial bottom and bench lands adjacent to the streams which supply their irrigation water. Most of these soils are the Laurel and Harlem soils on bottom lands. Smaller areas of higher adjacent lands are also irrigated, including the Wind River soils on benches and some of the Ethete, Arapahoe and Saddle series. The soil types of irrigated land have been determined on the reservation by Dunnewald and others, and their classification has been extended on to the area 1/.

VEGETATIVE COVER

The report area is characterized by a semi-desert vegetative cover with the sage brush type dominating 87 percent of the area. Other types in the order of their importance are grassland four percent, juniper and conifers four percent, and greasewood two percent. Waste and barren areas make up slightly over one percent of the classified range area. Four other types cover two percent of the area. The timber types are located in the Copper Mountains east of the Boysen Dam site and in the mountainous areas south and west of Lander. The cover is generally very sparse, vegetative densities ranging from five to sixty percent of the gound area being covered. Some areas are barren, located principally in badland formations and on rocky slopes. Location of the vegetative types is shown on the Vegetation Type Map, No. 1. Gross areas of the types with their grazing capacity is shown in Table 3 . Grazing capacity of the range lands is 321,308 animal unit months. The average surface acre requirement per animal unit month for the area as a whole is 6.37 acres.

In addition to the range lands there are 39,122 acres of crop land in the report area. This crop land is largely used to produce hay and grain for supplementary feed for range livestock. Other irrigated crop land in the basin is also available for the production of supplementary feed. At present crop lands furnish only 12 percent of the total feed requirements for livestock utilizing the grazing lands of the area. The grazing lands supply 88 percent of the animal unit months of feed utilized. Irrigated crop lands should be utilized as an elastic cushion to insulate livestock profits and range and livestock condition from fluctuations in forage production on the range. All livestock operators should have sufficient irrigated land in their base property to fully provide for such a buffer, to the extent of at least 20 percent of the total feed requirements. Crop land should be used for hay, grain and irrigated pasture. Irrigated pasture should be utilized whenever the available range is short of feed and when its use will benefit the range and the livestock. Hay should be stored for use during severe winters when range feed is lacking in quantity or availability. Proper integration of range and crop land use will result in range improvement and increased forage production and livestock profits.

1/ Soil Survey of the Lander-Riverton Area, Fremont County, Wyoming, by T. J. Dunnewald, O. Williams, and D. Stevens, 1932. An unpublished transcript of the Department of Agronomy, University of Wyoming, Laramie, Wyoming.

Condition of the Wind River range has steadily improved since the initiation of range use regulation in 1935. Unusually heavy precipitation combined with favorable distribution of the precipitation through the growing season during the years of 1938 to 1947, have been very favorable for range recovery and improvement in the Wind River Basin. Under natural conditions much of the range area in the basin is markedly lacking in suitable livestock water; distances between watering places being too great. Commencing in 1937, under the Civilian Conservation Corps program of the Division of Grazing, development of additional livestock water facilities has steadily increased in the report area. This has helped to relieve excessive livestock concentration in localized areas. In spite of the great progress in this direction, additional water supplies are needed.

The year 1948 was very dry during the growing season. There was ample moisture in the early spring so grass made an early growth but made very little additional growth during the summer as there was virtually no precipitation during July, August and September. This resulted in very low production of forage especially in the drier eastern portion of the basin. Shortage of feed was especially serious on fall and winter ranges in lower elevations of the basin. There was virtually no feed available on extensive areas. Many of the sheep operators depending upon this area for winter range sold out their flocks while others made arrangements to winter their flocks on supplemental feed.

Principal vegetative species of the report area in order of their forage importance are western wheat grass, Sandberg, blue grass, June grass, blue grama grass, niggerwool, blue bunch wheat grass, big sage brush, needle and thread grass, Idaho fescue, and Indian rice grass.

Growing season of the various range plants is principally dependent upon their individual critical growth temperatures and the available moisture supply. Growth response to moisture varies considerably between the several range plants according to their root systems and sites in which they are found. Grasses such as wheat grass and niggerwool have relatively deep extensive root systems combines with a low critical temperature; they are largely dependent upon winter and early spring moisture and make their maximum growth in the spring and early summer, Poa and niggerwool being the first grass forage available. Much the same is true of needle and thread and June grass. In contrast grama grass responds only to a higher temperature and makes virtually all of its growth in the summer and is largely dependent upon moisture falling during the summer grazing season. The shrubs are deep rooted and generally respond to total moisture supply during the entire growing season. They frequently dominate in areas where additional moisture is available from drainage, seepage or accumulation. The shrubs are especially valuable for winter grazing and are also very useful to supplement grasses on the spring-fall ranges in this area. Growing seasons for most of the grasses and shrubs starts sometime in April and continues into October. Many of the plants become dormant, enter rest periods, or ripen and complete their growth during the summer due to a combination of shortage of moisture, temperature or normal completion of their growth cycle. Some of the plants such as grama grass will renew growth activity whenever summer showers provide sufficient moisture.

Western wheat grass usually remains dormant during the hot, dry weather and makes a second growth in the cooler fall months if moisture becomes available. Spring is a critical growth period for most of the shrubs and grasses. Grazing intensity should be low from April 11 to May 15 in order to assure good forage production and range condition improvement.

The entire area is adapted to the grazing of sheep, horses and cattle. The eastern portion is especially adapted for winter sheep grazing; much of it is utilized by all classes of livestock throughout the year so that its maximum value as winter range is seriously reduced. Elevations from 6,000 to 7,500 feet, with considerable variation in length of seasons, and between years, are best utilized as spring fall ranges. Elevations in excess of 7,500 feet are best adapted for summer use. Length of seasonal use of these elevational differences varies greatly from year to year. Favorable open fall weather may enable operators to utilize feed even above 7,500 feet until Christmas time. Other years, storms may force livestock below the 6,000 feet level late in September. There is also a wide range in variation of commencement of suitable opening grazing dates in the spring according to elevation, largely dependent upon the disappearance of snow from the surface and vegetative readiness of the forage plants. Early fall snow and late spring disappearance of snow above 6,000 feet tend to throw unusually heavy use on the grazing lands at lower elevations as well as calling for additional use of supplementary feed.

Forest lands of the report area cover 84,365 acres of three types as shown on the vegetative type Map No. 1. There are 69,077 acres classified as woodland, coniferous timber 11,851 acres, and broadleaf trees 3,437 acres. The woodland is juniper, located in the foothills and low mountains in the eastern and southern portions of the area. The coniferous timber is a scrubby type of lodgepole pine with some Douglas fir situated at higher elevations of the mountains in the vicinity of Lander and Dubois. The broadleaf trees are principally aspen and cottonwoods located along the streams in the vicinity of Lander. None of this area is presently considered as commercial timber land, products being limited to posts, corral poles and fuel. Stands are scattered and scrubby, the juniper area probably being more accurately considered as range area than as forest. The timbered area is of primary value for watershed protection, livestock shelter, wildlife grazing and recreation. Site and climatic conditions in the timbered portion of the report area are generally not favorable for the production of timber of merchantable quality. Commercial stands of timber in the Wind River Basin are located on the National Forest and Indian reservation lands at higher elevations above the report area.

Table 3.- Acreage and grazing capacity of vegetative types within the report area of the Wind River Basin, Wyoming, 1947 1/

Vegetative Type No.	Name	Area (acres)	Grazing Capacity (AUM's) 4/	Average Area Requirement per Animal Unit Month (acres)	Percentage of Classified Area in each type (percent)
Classified:					
1	Grassland	81,346	11,884	6.85	4.20
2	Meadow	5,398	2,090	2.57	.28
4	Sagebrush	1,688,397	274,473	6.15	87.20
5	Mountain browse	765	196	3.90	.04
6	Coniferous timber	11,851	1,571	7.54	.61
7	Waste land	13,675	-	-	.71
8	Barren	11,222	-	-	.58
9	Juniper	69,077	6,892	10.02	3.57
10	Broadleaf trees	3,437	668	5.15	.18
13	Saltbush	6.268	1.119	5.60	.32
14	Greasewood	44,853	5,040	8.90	2.31
	Total Classified	1,936,289	303,933	6.37	100.00
Unclassified:					
	Range 2/	111,072	2/ 17,375	6.39	-
	Non-range land:				
	Crop land 3/	39,122	3/391,220	.10	-
	Townsites	893	-	-	-
	Total Unclassified	151,087	408,595	.37	-
	Total range	2,047,361	321,308	6.37	-
	Total non-range	40,015	391,220	.10	-
Grand Total		2,087,376	712,528	2.93	-

1/ Compiled from field inventories of the area for all classes of land ownership made by the Bureau of Land Management, Region III, Billings, Montana. See Map No. 1 , Vegetation Types, accompanying this report.
2/ Capacity for 89,399 acres of privately owned range land and 21,483 acres of State owned range land in the Dubois area were determined by calculation and field estimate. Only public lands were inventoried in the Dubois area. There are 190 acres of public domain range land in the Lander area which were not classified.
3/ Compiled from field estimates of average production of cropland in hay and irrigated pasture according to suitability, with use of all product and aftermath for livestock. Over three-fourths of crop production is for livestock feed, with some cash crop. Present actual production of livestock feed on cropland which is fed to livestock in the area is estimated to be 312,986 animal unit months.
4/ Animal Unit Months.

WATER RESOURCES

Water Storage and Irrigation Units

Missouri River Basin plans of the Bureau of Reclamation propose the construction of four dams and the development of 4,490 acres of irrigated land on the report area. Supplemental water will be supplied for 2,700 acres at present under irrigation. Location of these proposed developments is shown on the maps accompanying this report.

Boysen Dam, largest of the proposed developments, is under construction at the head of Wind River Canyon at the northern boundary of the Wind River Basin. This multipurpose dam will control and utilize the run-off of the entire basin, principally for the benefit of downstream irrigation, stream flow regulation, and flood protection. A hydroelectric power plant will be built in conjunction with the dam with a capacity of 15,000 kilowatts. Additional values of the dam are for silt control, wildlife, fisheries improvement and recreation. The Shoshoni unit of 16,600 acres will be irrigated by pumping from Boysen Reservoir. About three thousand acres of the Shoshoni pumping unit are located in the report area. Capacity of Boysen Reservoir will be 820,000 acre feet at the normal operating pool level and 1,493,000 acre feet at the maximum flood storage level. Normal pool of Boysen Reservoir will have a surface area of 19,659 acres and a storage capacity of 819,755 acre feet, with 81 miles of shore line. Drawdown will range from .2 to 29.3 feet with an average of 6.2 feet. Total cost of the Boysen Dam and power plant, with related works, is estimated to be $29,726,000. Collection of silt in the reservoir will diminish the water storage of this costly capacity. It is important to preserve the utility and prolong the useful life of Boysen Dam. Proper protection of this investment of public funds concerns the area and the entire Missouri River Basin. Much of this report is concerned with the accomplishment of these objectives as they pertain to the public domain area in the basin by reducing the amount of silt entering Boysen Lake. A total area of 8,298 acres needed for development of the Boysen unit has been withdrawn for reclamation purposes from the public domain. Privately owned lands have been purchased.

Badwater Reservoir is planned to have an estimated capacity of 7,500 acre feet to store run-off of Badwater Creek for the irrigation of 1,100 additional acres and for the present 2,700 acre area of Badwater unit. This is an off-stream storage site with an estimated reservoir surface area of 360 acres in Snyder Draw near Lost Cabin. Site of the reservoir is on public domain land.

Onion Flat Reservoir site is located on U. S. Highway No. 287 ten miles southeast of Lander on Devils Dive Creek. This is an off-stream storage with a planned capacity of 13,500 acre feet. A 4½ mile feeder canal will carry surplus run-off water from a diversion on the Little Popo Agie River. This storage water will be used to irrigate 5,700 acres of new land on the Hudson Bench unit of the Bureau of Reclamation. This land borders the report area. These bench lands are reported to be relatively fertile, well developed soils and well suited for irrigation use. Site of the reservoir is located on private and public domain land.

DuNoir Reservoir is planned to have a storage capacity of 260,000 acre feet, second in size to Boysen Reservoir. The site is located near Dubois along U. S. Highway No. 287. The primary purpose of this reservoir is to store water for irrigation use on 100,000 acres of new development on the Wind River Indian Reservation. An estimated 135 acres of public domain will be inundated by this reservoir and an additional 120 acres of public domain will be immediately adjacent to the reservoir.

Badwater and Boysen Dams will store water for irrigation developments on the report area, providing additional irrigable land which may be used for the production of supplementary feed for range livestock utilizing the area. Onion Flat Reservoir will store water for irrigated lands bordering the report area, which could also be utilized to augment the supply of supplementary feeds available for range livestock on the area for the mutual benefit of the range and livestock economy. While DuNoir Reservoir will store water for developments outside of the report area, lands supplied could be utilized to increase the supply of supplementary feeds available for range livestock within the Wind River Basin. A portion of such feed supplies would become available for livestock in the report area.

Surface Waters

Natural surface waters are not available on most of the area. Permanent streams exist in the Dubois area, in the vicinity of Lander and in the northeastern portion, but the bulk of the area east of Lander to the upper Badwater Drainage lacks permanent streams and lakes. Shortage of sufficient natural water for grazing use has brought about the development of many reservoirs, springs and wells for livestock water in this area. The location and type of all streams and the location of irrigated lands is shown on the maps accompanying this report.

Drainage areas and length of thirteen of the major streams in the report area are given in Table 19 in the appendix. Stream flow records of seven stations located on streams which drain from the report area are presented in Table 20 in the appendix. The amounts of maximum and minimum discharge are listed together with the average annual total runoff of the Wind River Basin as measured at Thermopolis, Wyoming, averages 1,115,470 acre feet per year. No flow records are available for streams located entirely within the area such as Badwater and Muskrat Creeks.

In the Dubois area, water supplies for livestock are largely furnished by surface waters. Wind River, the principal drainage, is a permanent stream with the following permanent tributaries: North Fork of the Wind River, Little Red Creek, Red Creek, Blue Hole Creek, Torrey Creek, Jakeys Fork, Little Warm Springs Creek, Warm Springs Creek, Crooked Creek, DuNoir Creek, Horse Creek, and Little Horse Creek. Virtually all of the land along these permanent streams is privately owned. The area is divided into operating units so that surface waters are available to the livestock. Water is used for irrigation by diversions from Wind River, North Fork of Wind River, Bear Creek, Horse Creek, Little Horse Creek, Tappan Creek, DuNoir Creek, Long Creek, Little Warm Springs Creek and Jakeys Fork. The irrigated lands are fenced off, restricting access to water for livestock. These croplands are used by grazing operators so that surface waters are made available to livestock. In addition to the permanent streams in the Dubois area there are twelve permanent lakes which augment the supply of surface water.

Stream types and their availability for livestock use in the eastern and southern portions of the area are summarized herewith:

North Fork of Popo Agie River is a permanent stream with irrigated land east of range 100 West. Topography above the irrigated area is so rough that livestock make little use of this stream. Paradise Creek is a permanent stream available to livestock for its entire length.

Mexican Creek is a permanent stream available to livestock in Section 15, Township 33 North, Range 101 West, and in its upper reaches. Steep, rocky canyons make it inaccessible to livestock in places above Section 12, and fences interfere with use below that point. Baldwin Creek furnished irrigation water for lands below Section 17 in Township 33 North, Range 100 West. In the next township west this creek is unfenced and available to livestock except for two miles of box canyon.

Squaw Creek is used for irrigation below Section 28, Township 33 North, Range 100 West. Above this section water is available to livestock at a few points. The Middle Fork of Popo Agie River is used for irrigation below Section 9, Township 31 North, Range 99 West. Above this point the stream is available to livestock, but little use is made of it because of the rough terrain. Lander obtains its water supply from this stream.

Twin Creek furnishes irrigation water for land along its course and one diversion supplies water to other drainages in Township 31 North, Range 99 West. Eleven miles of the headwaters is utilized by livestock. Beaver Creek is permanent and is utilized by livestock above the Yellowstone Ranch irrigation diversion in Township 30 North, Range 96 West. In its lower reaches water is available only in the spring and fall. Little Beaver Creek is a permanent tributary available to livestock.

Connant Creek is an intermittent stream with some water available in its lower reaches except in the driest part of the summer. Canyon Creek is another intermittent stream with springs near its headwaters. Deer Creek is also intermittent, with available stock water only in its headwaters in Townships 33, and 34 North, Range 89 West. Poison Creek provides livestock water in Township 37 North, Ranges 89 and 90 West.

Badwater Creek is a permanent stream above Lysite, but little of it is available for use in connection with grazing on the public lands from a point in Section 22, Township 39 North, Range 88 West, to the town of Lysite. Along this section of the creek, most of the water is used for irrigating adjacent hay meadows which are fenced. Below Lysite, the creek flows only in the spring and after storms. In Township 40 North, Ranges 87 and 88 West, there are springs and seeps in several of the side drainages of Badwater Creek which could be developed to supply more and better water for livestock using this area in the summer season. Most of these springs are on unfenced private land.

Bridger Creek is a permanent stream, most of which is fenced, and some of the water is used for irrigating adjacent hay meadows. At the lower end of the drainage, there are several water gaps where livestock can use the water in connection with grazing on public land on both sides of the creek. Owners of land along the creek have allotments or leases on public grazing land both east and west of the creek and use water owned by them in connection with their operations.

Alkali Creek is an intermittent stream with running water only during spring run-off and after heavy storms. Seeps occur along its course which provide some water for cattle and horses. Cottonwood Creek flows a small stream of water from the head of the creek south to Section 24, Township 40 North, Range 90 West, before it sinks into the stream bed. This water is available to stock using range lands east and west of the creek.

Most of the land bordering the live upper portion of Snider Creek is private and fenced. However, water is available to livestock at the several places which are open. Part of Lysite Creek is a live stream which passes through considerable private land. It is open, however, to livestock using adjacent open ranges.

Water is available to stock along Dry Creek in part of its upper length south to Section 18, Township 39 North, Range 92 West, where it sinks into the stream bed. There is some irrigated cropland along the creek, and some water is used for irrigation north of Section 18. Running water prevails in Hoodoo Creek south to Section 10, Township 39 North, Range 93 West, where it sinks into the stream bed. It is open to livestock except a short distance along its course where there is a small amount of irrigated cropland. Water in Tough Creek runs south to Section 12, Township 39 North, Range 94 West, where it sinks into the stream bed. It is open and available to livestock using the open range.

Dry Fork in Township 39 North, Ranges 87 and 88 West, is an intermittent stream with several seeps in its upper reaches which could be developed to furnish more water for livestock using this area. Clear Creek has running water southward from Section 21, Township 40 North, Range 88 West. Several seeps and springs are located above this location and could be developed for stock water purposes.

There is running water in Sioux Creek above Section 28, Township 40 North, Range 89 West. There are springs in some of the side drainages above this location. Water is diverted from this drainage for irrigating land in the west part of Section 28, Township 40 North, Range 89 West. Water is available along Birdseye Creek in Township 40 North, Range 94 West, except where the private land is fenced.

A number of stockwater reservoirs have been constructed on the public lands under the Civilian Conservation Corps Program and Range Improvement Program of the Bureau of Land Management. More are needed to facilitate the proper utilization of the forage resources. Some springs have been developed in the area. More development is contemplated in the eastern portion where there are several springs on public lands. Railroad reservoirs north of Bonneville, Lysite, and Arminto are used by livestock grazing adjacent public range. The reservoir north of Lysite and also the one north of Arminto are near or adjacent to stock driveways. Most of the other private stockwater reservoirs are small and fenced with the private holdings, use being made of them when private lands are grazed. Many of these stockwater reservoirs have been constructed within the past ten years under the agricultural conservation association program. Map No. 2 shows water facilities which have been constructed, and those which are proposed to improve the utilization of the range resource.

CULTURAL AND ECONOMIC DEVELOPMENT

Settlement History

Active settlement of the area began in the Popo Agie valley in 1865 increasing in 1867 as the gold mines in South Pass began to play out. In 1870 the Popo Agie valley was all settled. Settlement spread to the north fork of the Popo Agie in 1879. Settlers moved into the Lost Cabin and Badwater country in 1890, and Dubois was settled in 1895. The Riverton valley along the Wind River was opened for settlement in 1906 and was well settled by 1908.

Veterans were active in homesteading public domain lands in the basin in 1919 to 1920. Most of these lands were later sold to sheep companies. In the coal mining years, Hudson was a city with a $75,000 mine payroll monthly. It supported two large department stores and four banks. When the mines closed Hudson became a small community. Lost Cabin at one time was the center for a huge cattle and sheep enterprise with a large department store and other businesses.

Economic conditions favorable to the area gradually increased the population until low farm prices shortly after 1920 began to show their effect and population gradually declined. Drouth years of 1934 to 1938 attracted some farmers from Nebraska and South Dakota to irrigated lands in the area. This additional settlement, however, was not sufficient to offset the population losses due to economic conditions in the period and 1940 saw a further reduction in the population of the area. The war years brought a further reduction in population due to calls to the service and employment opportunities in war work outside of the basin. With the conclusion of hostilities, many of the service men and war workers returned to the basin. Development of additional irrigated lands brought in new settlers. New activities in oil and gas development and renewed tourist travel further increased both population and economy.

Population and Public Facilities

Resources of the report area support a sparse permanent population of approximately 7,000. Limitations, largely imposed by climate and available irrigation water supply, restrict the agricultural development of the area. It is so poorly adapted to settlement that 61 percent of the area remains in Federal ownership. Largest settlement in the area is the town of Lander, County seat of Fremont County, with a population of about 3,000. Riverton is another large town near the area in Wind River Basin. All equipment and supplies needed for farming or ranching may be purchased in Lander or Riverton and all farm and livestock products can be marketed and stored there. Dubois is a town of 500 in the western portion of the area. Smaller communities within this area are Shoshoni, Hudson, Bonneville, Lysite, Arminto and Moneta. All towns but Moneta and Dubois are on the railroad with facilities for shipping livestock. Hudson and Lysite are important livestock shipping points. Hudson has a cooperative creamery and coal mining is a significant enterprise.

The report area is served by two railroads; the Chicago and Northwestern from Omaha, which terminates at Lander, and the Chicago, Burlington and Quincy from Billings, Montana, to Denver, Colorado. These railroads have 103 miles of standard gauge track in the area. They connect with the railroad system of the United States. The Challenger Air Lines provides daily passenger and mail service on its routes from Billings to Salt Lake City and Denver. Bus service is provided by the Burlington Trailways along Highway 20 and by the Robinson Transportation Company from Shoshoni to Riverton and Lander on their routes to Casper and Rawlins. All towns and most of the communities are on truck freight routes.

Three hard surfaced highways cross the report area; U. S. Highway No. 20 enters the area from the east and turns northward down Wind River Canyon to Thermopolis, Cody and Yellowstone National Park; U. S. Highway No. 287 from Rawlins to Grand Teton and Yellowstone National Parks crosses the area from the southeast corner, going through Lander to Dubois. Wyoming State Highway No. 320 extends from Shoshoni to Lander. Wyoming State Highway No. 28 goes from Lander over historic South Pass to Rock Springs, Wyoming, where it connects with U. S. Highway No. 30 east and west. This highway will be surfaced over South Pass in 1949, affording a new short all-paved route to Salt Lake City. A network of gravelled and improved roads covers the farm area and oil fields. Most of the range area is provided with trails which are adequate for the use required.

Transmission lines of the Mountain States Power Company and of the Bureau of Reclamation cross the area, serving all communities and many of the farms and ranches in the area with electric power and light. The Bureau of Reclamation has a 6,000 kilowatt hydroelectric power plant at Pilot Butte on the Riverton project in the Wind River Basin and will produce 15,000 kilowatts at the new Boysen Dam hydroelectric plant. A hydroelectric plant on the Popo Agie River operated in conjunction with a diesel plant in town furnishes power for Lander. The third existing hydroelectric plant is on Warm Springs Creek, furnishing power to Dubois. Natural gas is piped to the towns and some of the smaller communities in the area.

The Riverton Valley Rural Electric Association distributes power to farms and small communities on the Riverton project and in the vicinity thereof, including parts of the report area. The Dubois Public Service Company purchases power from the Bureau of Reclamation at Pilot Butte, distributing it on a line extending to Burris. They plan to extend this line to their Dubois system.

A transcontinental telephone line of the Bell System crosses the eastern part of the basin. All of the communities and many of the farms and ranches are provided with telephones connecting with the Mountain States Telephone Company lines. All railroad stations provide Western Union telegraph facilities. There are 3,000 miles of telephone and telegraph lines in the basin. Radio stations are located at Lander and Riverton. Government radio communication is maintained by the Forest Service and the Bureau of Indian Affairs at their headquarters and ranger stations.

Fremont County has a County Agent and Home Demonstration Agent of the Department of Agriculture. Dairymen in the area have an organization, the Farmer's Cooperative Dairy Association, with 140 members and a Co-operative Creamery at Hudson. The National Grange is active in the basin.

Prominent among educational institutions in the basin is the Wyoming State Training School, a large vocational boarding school at Lander. High schools are located at Dubois, Lander, Riverton, Shoshoni and Lysite. Grade schools are located at all of these points, in smaller communities and at points in farm sections. High schools and the larger grade schools operate school busses with routes covering the farm sections. Churches are located in all of the towns in the area. Social organization groups are active in Lander and Riverton. Motion picture theatres are located in Dubois, Hudson, Lander, Riverton and Shoshoni.

Markets

Livestock markets are provided by a sales ring in Riverton which caters to local feeders and order buyers, and by out shipment, mostly to Denver and Omaha. California buyers are active at times and local buyers reside at Lander and Riverton. Farm and livestock products may be marketed and stored at Riverton and Lander. Some livestock goes northward to Big Horn Basin points and to Billings, Montana. Livestock are shipped out by rail over the C. B. and Q. Railroad to Denver and eastern points and by the Chicago and Northwestern Railroad to Omaha. A portion of the livestock are trucked out, especially those for delivery within Wyoming.

Distances and shipping costs to market are high, Denver being 300 miles southeast, Omaha 700 miles east and Los Angeles 800 miles southwest. The limited capacity of local markets forces the production of high value concentrated commodities such as livestock and their products and permits the use of the bulk of the farm land for relatively low value feed crops.

INDUSTRY

Agriculture

Beef cattle have supplanted sheep as the principal type of livestock production area. Sheep numbers are still substantial, however, and this is one of the leading areas for sheep production in the State of Wyoming. Considerable numbers of horses are also raised in the area. Dairying is also a leading industry in the area, creameries being located at Hudson, Riverton and Lander. Principal product of irrigated lands is livestock feed in the form of alfalfa and other hays and grain. Cash crops are also important, especially during the war period and recent years of high product prices. Beans and small grains have been the leading cash crops. Seed crops, sugar beets and potatoes are important crops on irrigated farm land in the area although the total percentage of farm land devoted to these crops is not very large.

Size of the operating units of range operators, those who farm exclusively and of those who combine both enterprises, varies greatly with the individual, his capital, equipment, desires and the use and ownership pattern of lands within his reasonable operating area. Characteristics of the range call for extensive use with widely separated headquarters. Ranches cannot support public services and institutions to a degree comparable with farming areas.

Farm size has steadily increased in recent years, largely due to mechanization and the rising cost of labor. In 1948, the average farm operating unit in the area was about 200 acres of cultivated irrigated lands. Normal ownership and operating farm area in the vicinity of Lander is 120 acres. Most of these Lander area farm operators also have livestock on range most of the year, their principal crop being hay for winter feeding. In the vicinity of Riverton, 160 acres is the average ownership area, with additional farm land frequently added to the operating unit by leasing. Farm land ownership and operating area is seldom less than 40 acres and ranges up to the 2,300 acres of the Yellowstone Sheep Company.

Farm operations of range livestock operators vary greatly in size from those who use no farm land, relying upon range and purchased supplements exclusively, up to those with large areas of farm land using range lands as a complement to their farm operations. Some operators rely on range feed exclusively if possible, while others utilize supplemental feeds whenever their livestock will benefit by feeding. Irrigated farm areas of feed producing ranchers on the public domain area varies from 30 to 2,300 acres, with an average of about 120 acres.

Higher living standards coupled with high costs of efficient equipment for completely mechanized farming have further stimulated increased farm operating area. In most of the basin farm lands are usually reasonably priced and acreages are available for leasing. These conditions have enabled most farmers to develop an operating unit to suit their desires and equipment. Development of irrigated farming in the area has helped to stabilize the local livestock industry utilizing the range. This stability has been due to the production of supplementary feeds such as hay, grain, irrigated pasture and crop by-products which are available for livestock use during

periods when range feed is short in supply, or unavailable for use because of snow cover or other conditions. Production and use of supplemental feeds in the area enable livestock to survive winters which they could not endure on range feed alone and also enable operators to maintain foundation breeding herds over protracted drouth periods which would otherwise necessitate most operators disposing of their herds or flocks if dependent upon range feed alone. Judicious use of supplemental feeds also enables operators to make greater economic returns and more efficient use of their animals both on a unit and gross operations basis.

Development of irrigated farm land has also served to retain water in the area, converting it into supplemental livestock feed and cash crops for the benefit of both local livestock and general economy of the basin. Irrigation farming greatly increases the productive value of range land in the basin, increasing the animal unit months of feed production per acre from only one-tenth to ten or more, or over one hundred times. Dollar value of the product is correspondingly increased from one cent annually to a figure which may substantially exceed one hundred dollars per acre, an increase of 10,000 times or more.

Production and use of supplementary feeds on irrigated farm lands benefits the range by making it possible to defer grazing and properly seasonal range use. Stocking of range lands can be balanced with forage production because supplemental feeds are available for the surplus livestock. Provision of supplemental feed from irrigated land makes it possible to prevent overgrazing with its attendant damage to range cover and creation of erosion. Permitted use of the Federal range in the area is 183,385 animal unit months, which is 23,920 animal unit months in excess of the grazing capacity of 159,465 animal unit months. Actual use is estimated to be 135,431 animal unit months for the Federal range.

Irrigation practice has created some conservation problems. Irrigation is an erosive process as well as being a means of producing crops. Low cost land and water have induced poor irrigation practices in portions of the area, resulting in seepod lands, drainage problems, alkali, excessive siltation of waste water and accelerated erosion. Proper preparation of the land for irrigation combined with good irrigation practice and ample provision for drainage of waste water without erosion or seepage, would prevent most of the trouble which has been experienced. Supply ditches of irrigation systems should be designed and constructed so that excessive loss and seepage do not occur. Such loss is not only wasteful of the limited valuable irrigation water supply but also creates drainage problems and damages land by creating areas with a high water table and develops concentration of salts in the surface soil.

Development of irrigation agriculture in the basin has greatly improved the cultural and social facilities of the basin area because of the increased population and economy which the production of the irrigated farm land requires and supports. Better roads, schools, churches, stores, amusements, transport, local government and supplies are available to the range operators because of settlement of the irrigated lands. All segments of the resource economy, farm, range, mineral and recreational, contribute to the development and support of the economy and to the cultural growth and advancement of the area.

In addition to the favorable factors for range use created by irrigation development in the area, some unfavorable conditions have resulted. Pressure for range land is increased because farm operators desire range for their livestock. In a few places, access to water, feed or normal stock travel routes have been cut off by farm development. Farm livestock have overgrazed adjacent range areas in the basin where grazing lands are limited in extent. There is little idle or abandoned crop land in the public domain area, although seepage and alkali have caused the abandonment of substantial areas of farm lands in some parts of the basin. Those lands are now primarily used for pasture. Most of these areas can be reclaimed by drainage and proper management.

Size of operating units of livestock operators vary widely. Within the Wind River Grazing District the number of such operators, who own from one to 50 animal units, is 48 or 25 percent of the 194 operators. The number of operators owning 51 to 100 animal units is 43 or 22 percent; those owning 101 to 200 animal units is 31 or 16 percent; those with 201 to 500 animal units is 17 or 9 percent. There are 13 operators owning over 1,000 animal units, which is 7 percent of the total number of operators. Table 6 shows the number of operators within the Wind River Grazing District in the basin distributed on the basis of the numbers of the four principal classes of livestock.

Mineral Resources 1/

Minerals are an important resource of the public domain area in Wind River Basin. Petroleum, natural gas, coal and gold have been produced for many years. In addition there are large deposits of phosphate rock, and small amounts of tungsten, tantalite, columbite, beryl, bentonite, vermiculite and asbestos.

Oil is produced in the Muskrat, Sand Draw, Alkali Butte and Dallas-Derby fields. Exploration and additional development was active in the years 1946 to 1948, and is increasing. Oil fields on the reservation are heavier producers than minor fields on the public domain area. Present production of the entire basin is in excess of 6,000,000 barrels annually. Production of the public domain area is about 600,000 barrels each year. Natural gas is produced in the larger oil fields, the principal production being located at Big Sand Dome and Muskrat Dome, which yields 6,000,000,000 cubic feet of gas annually. Total production of the basin was 9,365,246,000 cubic feet in 1948.

Early history and settlement of the area was greatly influenced by gold mining in the Atlantic Mining District during the years 1867 to 1875. Gold was discovered near South Pass in 1842, and the Carissa lode was opened in 1867. Population increased from 700 to 7,000 in 1870. Production is said to have been from $2,000,000 to $4,000,000. As the workings gave out, many of the miners settled on the nearest desirable agricultural land in the Popo Agie valley. Since 1875 the mines have been worked intermittently, the Carissa and one small mine being the only mines in operation in 1948. They produced gold valued at $12,372.

Coal occurs in lenticular deposits with small area lenses in Wind River Basin. Outcrops occur in four parts of the basin, two being on the reservation, one on the public domain area, and the Hudson outcrop extending across the boundary, being in both the reservation and the study area. Coal was mined from the time of settlement, extensive mining beginning with the opening of the Chicago and Northwestern Railway to Lander in 1906. Hudson was an important coal mining center from 1912 to 1941, with a monthly mine payroll of $75,000. Production in 1937 was 45,473 tons, 28,876 tons being shipped by rail or used for railroad fuel. These figures declined to 37,733 tons produced and 21,250 tons of rail use and shipment in 1940, with a further decline to 34,502 tons and 17,410 tons respectively in 1941. Operation of the larger mines and railroad shipment ceased in 1942 when 18,511 tons were produced with 5,606 tons being shipped or used by the railroad. Four mines operated in 1948, to produce 8,600 tons of coal valued at $14,652 for local consumption. One of these mines is on the reservation and three are on the public domain area near Hudson. All are small scale hand loading mines with four or five employees. Mining is done in the winter, sales being made to truckers and local consumers. The coal is a low grade bituminous which does not store well. It cannot compete with fuel oil or natural gas which are available locally or better grade coals which are produced elsewhere in Wyoming. Coal reserves of the area may become an important resource for conversion products, heat or energy. 2/

1/ Resume of mineral resources of the Wind River Basin, Bureau of Mines, 1948.
2/ A study of coal mining operations in the Wind River Region, Fremont County, Wyoming, by Raymond G. Travis, U. S. Department of Interior, Bureau of Mines, Rapid City, South Dakota, Preliminary Report No. 23, February, 1949.

Large deposits of phosphate rock are located southwest of Lander in the public domain area, over 25,000,000 tons having been blocked out by core drilling carried on by the Bureau of Mines. This Bureau made an investigation proposing a mine to develop 500 tons of raw rock daily, which would be treated to produce 100 tons of phosphoric acid. Rock would be crushed at Lander and processed in electric furnaces at Casper under their proposal. An investment of $5,844,000 in mine, mill, electric treating plant and access railroad would produce phosphoric acid at a cost of about $75.00 per ton, indicating the probability of substantial profit from the enterprise.

Reserves of scheelite, a tungsten mineral, are estimated to be 6,750 tons or more. Deposits are located in the Copper Mountain District. Tungsten content averages 75 percent but freight and treatment charges have not allowed a profit and mining operations have been abandoned.

Wildlife

Principal big game species found on the report area are antelope, deer and elk. In addition, small numbers of moose, black bear and mountain lion occasionally use parts of the area. Coyotes are common and constitute a predator problem. Bobcats are numerous. Beaver find a suitable habitat along all of the permanent streams where cottonwood, willow and aspen are thick enough to provide sufficient food. Among the rodents, three types of rabbits are very common, cottontail, jack and showshoe. Prairie dogs are also numerous, mostly living in scattered holes rather than in towns, which are their usual habitat in the great plains. At higher elevations marmot and porcupine are commonly found. In the streams and lakes, muskrat, mink, beaver, fisher and otter are found. Badger and skunk are common animals on the area and some weasels are also found. Migratory ducks and geese utilize the water surfaces of the basin, especially during the fall months. Upland game birds include Chinese pheasants with smaller numbers of sage chicken, blue grouse, hungarian partridge, prairie chicken and sharptail grouse. Permanent streams of the area provide excellent fishing especially at the higher elevations where trout abound. Present populations of the more important animals have been determined for the eastern part of the area by the Range Manager of the Wind River Grazing District and the Wyoming Game and Fish Commission. Wildlife population numbers of the Wind River Grazing District in 1948 were: antelope, 7,226; mule deer, 1,260; elk, 253; moose, 50; beaver, 200; fox, 70; badger, 185; mink, 110; muskrat, 135; skunk, 380; weasel, 530; marten, 15; bobcat and lynx, 115, and coyote, 550.

Forest Products

Forest products are processed and transported in the report area. They are produced principally from lodgepole pine stands on the National Forest. Commercial use of the forest is largely the production of railroad cross ties, centering at the Western Tie and Timber Company camp near Dubois, with a treating plant at Riverton. Other products are poles, posts, mine props and stulls, and rough lumber. Six portable sawmills operate periodically and their total annual output is comparatively small. Pulp wood harvesting may become an important future industry in the basin.

Recreation

Recreational use of the report area consists of big game hunting, trout fishing on the permanent streams, and camping and picnicking in the upper reaches of Twin Creek, Beaver Creek and the Little Popo Agie River. Recreational use of the Wind River Mountains in the National Forest above the report area is an important segment of economy in the area. Location of the area along principal routes to Yellowstone and Grand Teton National Parks creates considerable tourism business for the towns and settlements along these highways. Dude ranches and organized summer camps in the vicinity of Dubois feature pack trips to scenic glacial lakes, mountain peaks, snow fields and trout streams. Accomodations are provided for hunters, fishermen and tourists at Lander, Dubois, Torrey Lake, Shoshoni and Hudson in the report area.

Fishing is the principal recreational use of the area in the upper Popo Agie River drainage. Estimates of such recreational use for 1947, was 4,800 persons utilizing the recreational resources less than one day, and 5,400 camping in the area one or more nights. Larger streams, and Ring, Trail and Torrey Lakes in the Dubois area are fished frequently during the season. The State of Wyoming has a fish hatchery on Jakey's Fork near Dubois. Additional recreation areas for fishing and aquatic sports will become available with the completion of Boysen, DuNoir and Onion Flat Dams. Improved camp grounds should be developed at several places along Twin Creek, Beaver Creek and on the NE$\frac{1}{4}$ of the NW$\frac{1}{4}$ of Section 30, Township 42 North, Range 107 West, near Dubois, and on Lot 1, Section 4, Township 40 North, Range 104 West, along the North Fork of Wind River. Ample provision for camp areas should be made in leases involving the sites chosen. The forty acres described near Dubois should be withdrawn from leasing and reserved for camping and the 80 acres of public domain just west of it should be reserved for recreational use when DuNoir Dam has been built.

Big game hunting is important at higher elevations in the Badwater Creek, Beaver Creek and Popo Agie River drainages. Mule deer are the only animals hunted here, about 400 being taken from the public domain area annually. Antelope graze over the area at all seasons, but hunting is limited. Antelope hunting was first opened in the fall of 1948, and will probably become increasingly important. A total of 3,582 hunters were checked through the State of Wyoming big game station at Dubois in 1946, with a kill of 2,272 elk, 100 deer, 116 moose, 10 mountain sheep, and 27 bear. Nearly all of this game was killed above the public domain area. Some years early snows drive game down into the public domain area near Dubois during the open season.

LAND OWNERSHIP and OPERATING PATTERN

Relationship of report area to other land-use program areas in the Wind River Basin.

As depicted on the map preceding page III area of the Wind River Basin is 4,954,092 acres. Four agencies of the Federal government administer lands in the basin. The Bureau of Land Management administers the public domain within the report area of 2,087,376 acres, 42 percent of the basin. The Bureau of Indian Affairs administers the Wind River Indian Reservation, 2,017,756 acres in extent or 41 percent. The Forest Service, Department of Agriculture, administers 848,960 acres in the Washakie National Forest, an administrative division of the Shoshone National Forest, and which constitutes 17 percent of the basin. The Bureau of Reclamation is developing the Riverton project, an area of 375,081 acres, all of which has been withdrawn from the Wind River Indian Reservation. Headquarters of the governmental agencies administering Federal land within the basin for the respective agencies are as follows: Bureau of Land Management, Lander, Wyoming; Bureau of Indian Affairs, Wind River Indian Agency, Fort Washakie; U. S. Forest Service, with District Ranger Headquarters at Lander and Dubois; and, the Riverton project of the Bureau of Reclamation, Riverton.

Land ownership in the basin is of four types: Federal, 1,272,943 acres; Indian, 1,853,326 acres; State of Wyoming, 194,420 acres; and private, 787,042 acres. The lands in Federal ownership are of two classes, public domain and withdrawals therefrom, with 1,272,943 acres, and National Forest land 846,361 acres. Indian lands are of two types: the tribal area is 1,718,071 acres and the allotted acreage is 135,255. Gross basin area of 4,954,092 acres is 43 percent Federal land, 37 percent is Indian land in Federal trust, 16 percent is privately owned and 4 percent is State of Wyoming land. Eighty percent of the land area classified by ownership is administered by three agencies of the Federal government: the Bureau of Land Management administers 26 percent; the Bureau of Indian Affairs 37 percent, and the Forest Service 17 percent.

Other Federal land-use agencies are also active in the basin. The Extension Service of the Department of Agriculture has county and home demonstration agents for each of the three counties within the basin. The Soil Conservation Service renders technical service to the four soil conservation districts within the basin, with units located at Dubois, Lander and Riverton. The Production and Marketing Administration administers land use conservation programs in each of the three counties.

Land ownership and operating pattern within the report area

Gross area of the report area is 2,087,376 acres, which is made up of 1,272,943 acres of Federal public domain and withdrawals therefrom, 620,013 acres of privately owned land and 194,420 acres of land owned by the State of Wyoming. On a proportional basis, 61 percent of the area is federally owned land and 39 percent is in other ownership, of which 30 percent is privately owned and 9 percent is in State ownership. Wind River Grazing District contains 1,472,466 acres of public

domain area in the basin, or 71 percent of the total. There are 614,910 acres outside of the grazing district, which is 29 percent of the total. Lands in Federal government ownership total 1,065,361 acres inside of the district or 51 percent of the total area. Federally owned lands outside of the grazing district in the area total 207,582 acres, or ten percent of the report area. State and private lands are equally divided inside and outside of the district, there being 407,105 acres inside the district and 407,328 acres outside of the district. This amounts to 19½ percent of the report area being state and private lands inside the grazing district and 19½ percent of the area in that ownership outside of the grazing district. Acreage within the study area by classes of ownership, location and types of use are presented in Table 4 together with their respective carrying capacities in animal unit months. Table 1 presents an analysis of areas by ownership and location within the area, both in and out of the Wind River Grazing District.

While this report concerns only the public domain area, it seems advisable to mention the extent of the other administrative areas within the Wind River Basin as their use is correlated in many cases. The Wind River Indian Reservation, 2,017,756 acres in gross area within the basin, separates the Wind River Grazing District and its associated public domain lands from the public domain area around Dubois in the western end of the basin, and also divides the National Forest area of 848,960 acres into two segments. Included within the boundaries of the reservation is 325,081 acres of withdrawal area for the Riverton project of the Bureau of Reclamation. Gross area of the Wind River Indian Reservation in the basin is made up of 1,853,326 acres of Indian land, 1,718,071 acres of which are tribal and 135,255 acres of which are allotted Indian lands with 164,430 acres of privately owned and patented lands.

Federally owned public domain lands and State of Wyoming lands are adapted to grazing, wildlife, watershed and forest uses. As they comprise 70 percent of the study area, the burden of proper conservation use and development is thrown on these lands, the Bureau of Land Management being the responsible agency as it administers 61 percent of the land area.

Privately owned lands are 30 percent of the study area. Most of the private lands are grazing lands with less than 2 percent of the area being privately owned irrigated farm lands. Irrigation farming is a most important use of the private lands in the area not only because of its economic and social importance but also because production of supplemental feeds on such lands usually permits stabilization of the livestock industry and a more orderly use of the range resources. A portion of the privately owned range land is held for oil speculation. As the irrigated land is privately owned, conservation problems of proper water use, drainage, waste water disposal, alkali seeped lands, irrigation water supply and distribution, are the concern of the private owners. They are given technical assistance by the Soil Conservation Service of the Department of Agriculture through the Wind River, Popo Agie and Dubois-Crowheart Soil Conservation Districts. Irrigated lands

Table 4.- Acreage and grazing capacity by classes of land ownership and types of land-use, within the report area of the Wind River Basin, Wyoming, 1947 1/

Ownership, Class & Type	Within Wyoming Grazing Dist. #2: Area (acres)	Within Wyoming Grazing Dist. #2: Grazing Capacity (AUM's)4/	Outside Wyoming Grazing Dist. #2: Area (acres)	Outside Wyoming Grazing Dist. #2: Grazing Capacity (AUM's)4/	Total Report Area: Area (acres)	Total Report Area: Grazing Capacity (AUM's)4/
Grazing Lands:						
Federal public land						
Public domain	938,276	144,753	192,061	28,896	1,130,337	173,649
Withdrawn lands:						
Stock driveway	115,792	3/ 18,703	13,686	1,790	129,478	20,493
Power & water reserve	3,322	414	460	83	3,782	497
Reclamation	7,971	1,039	-	-	7,971	1,039
Target Range	-	-	1,320	196	1,320	196
Total Federal land	1,065,361	3/164,909	207,527	30,996	1,272,888	195,905
Other Lands:						
State of Wyoming	128,574	19,996	65,846	10,932	194,420	30,928
Private	270,261	43,513	309,792	50,962	580,053	94,475
Total other lands	398,835	63,509	375,638	61,894	774,473	125,403
Total Grazing Lands	1,464,196	228,418	583,165	92,890	2,047,361	321,308
Non-Grazing Lands:						
Cropland 2/						
Private	7,960	79,600	31,107	311,070	39,067	390,670
Public domain	-	-	55	550	55	550
Townsites, private	310	-	583	-	893	-
Total non-grazing land	8,270	79,600	31,745	311,620	40,015	391,220
Total all ownerships and types	1,472,466	308,018	614,910	2/404,510	2,087,376	2/712,528

1/ Compiled from field inventories by the Bureau of Land Management, Region II Billings, Montana. Capacity of 21,483 acres of State of Wyoming land and 89,399 acres of private land in the Dubois area has been determined by calculation and estimate, only federal land being inventoried in that area.

2/ Cropland capacity has been estimated at ten animal unit months per acre. This allowance could be increased if cropland were efficiently utilized solely for livestock feed. The average yield of alfalfa is 2½ tons of hay or ten animal unit months per acre plus one animal unit month for alternate pasture. Supplemental feeds can also be produced on irrigated lands on the reservation or they may be shipped into the basin.

3/ Only 5,444 animal unit months of stock driveway grazing capacity on federal range in the grazing district is used for driveway. The allowable grazing capacity of the stock driveway is 13,259 animal units, making a total net allowable grazing capacity on the federal range in Wyoming Grazing District #2 of 159,465 animal unit months.

4/ Animal unit months.

in the area are usually owned by the operator. Tenure is usually stable, lands often remaining in the family for generations.

Development of irrigation farming has had two opposite effects on range land use. Provision of hay, grain and irrigated pasture has helped relieve pressure on the range lands for feed. The increase in population and entry into the livestock business by farmers has also helped to increase the demand for grazing lands. Virtually all of the public domain lands suitable for irrigation farming were settled and passed to private ownership before 1915. Public domain lands remaining are suitable only for grazing, watershed and forest uses, except for areas under the proposed irrigation development of the Shoshoni and Badwater units of the Bureau of Reclamation.

Use of grazing land for non-Indians on the reservation has been restricted since 1940, all of the grazing land there now being used by Indians. This threw an added demand for grazing on lands in non-Indian ownership in the Basin, increasing grazing use of the report area.

The public domain area of the Wind River Basin is not a complete operational area, as many of the operators utilize summer range on the National Forest or elsewhere. Base properties for the production of supplementary feed are within, or adjacent to, the area. Table shows the seasonal use and type of feed available for livestock permitted on the grazing district. Table 5 shows the estimated actual seasonal use of forage by permitted livestock on the Wind River Grazing District within the report area. Public domain lands in the area are utilized by the operators under ten year permits or yearly licenses on the grazing district and by leases of ten years or less to the owners of adjoining lands on the balance of the area. Most of the grazing district is now operated under ten year permits, and the portion under this plan is increasing.

The operating unit Map No. 4 , shows the land owned and controlled by the 253 operators using public domain lands in the areas. Grazing district operators are mostly large scale operators except in the southwestern portion, where small scale operators with base property on irrigated lands in the vicinity of Lander predominate. Operators on the public domain land area in Natrona County east of the grazing district are large scale operators. Operations in the Dubois area are carried on mostly by small scale operators. Number of grazing district operators classified by the size of their enterprise in animal units is shown in Table IV of the appendix lists range operators referred to on Map No. 4.

Range land in Fremont County is assessed at $1.92 an acre, and irrigated farm land at $22.42 to $39.82 per acre. Natrona County range land is valued at $1.75 per acre for tax purposes. Fremont County farm land is assessed at $11.41 to $39.82 per acre. Sale prices of farm land have ranged from $20 to over $100 per acre in recent years, while prices paid for range land have varied widely, largely dependent upon the degree of oil speculation or range use control involved. High prices for farm products have sharply raised farm land prices in recent years.

Table 5.- Estimated seasonal grazing use of federal range by class of livestock in Wyoming Grazing District #2, Wind River Basin, Wyoming, 1946-47 (animal unit months) 1/

Class of Stock	Winter Dec. - Febr.	Spring Mar. - May	Summer June - Aug.	Fall Sept. - Nov.	Total Yearlong
Cattle	7,664	13,681	23,979	20,993	66,317
Sheep	17,577	17,421	12,275	15,871	63,144
Horses	897	1,508	1,875	1,690	5,970
All Classes	26,138	32,610	38,129	38,554	135,431

1/ Compiled from records of the Range Manager, Wyoming Grazing District #2, Lander, Wyoming, Bureau of Land Management, Region III, Billings, Montana

Table 6. - Size and types of livestock operations in Wyoming Grazing District #2, Wind River Basin, Wyoming, 1947 1/

Animal Units Owned (number)	Cattle Operators (number)	Cattle Total (animal units)	Sheep Operators (number)	Sheep Total (animal units)	Horses Operators (number)	Horses Total (animal units)	Combination Operators (number)	Combination Total (animal units)	Total all Classes Operators (number)	Total all Classes Total (animal units)
1 - 50	36	1,067	2	72	7	200	3	109	48	1,448
51 - 100	28	2,164	7	473	-	-	8	596	43	3,233
101 - 200	22	3,214	3	420	-	-	6	742	31	4,376
201 - 500	19	6,127	18	6,757	-	-	5	1,717	42	14,601
501 - 1,000	4	2,595	10	7,421	-	-	3	2,666	17	12,682
over - 1,000	2	3,930	7	12,990	-	-	4	11,804	13	28,724
Total	111	19,097	47	28,133	7	200	29	17,634	194	65,064

1/ Compiled from records of Wyoming Grazing District #2, Lander, Wyoming, Bureau of Land Management, Region III, Billings, Montana

Table 7.- Type and source of available feed for livestock permitted in Wyoming Grazing District #2 Wind River Basin, Wyoming, 1946 1/

Type and Source of Feed	Winter Dec. - Febr. (AUM's)	Spring Mar. - May (AUM's)	Summer June - Aug. (AUM's)	Fall Sept. - Nov. (AUM's)	Total Yearlong (AUM's)	Percentage of total feed (percent)
Hay, concentrates-private	29,213	16,667	-	1,009	46,889	11
Pasture - Private	905	2,337	469	1,247	4,958	1
Range - Private	41,727	42,126	44,642	43,471	171,966	40
Range - Public lands within Wind River Grazing District	38,544	48,352	45,271	51,218	3/183,385	42
Range - Public lands outside Wind River Grazing District	460	1,679	12,345	7,926	22,410	5
Range - National Forest	-	50	5,347	658	6,055	1
Total	110,849	111,211	108,074	105,529	435,663	100

1/ Expressed in animal unit months of feed available in 1946 according to records of the Wind River Grazing District, Lander, Wyoming. Compiled from sub-area reports for the Badwater and Muskrat-Lander areas, Bureau of Land Management, Region III, Billings, Montana, 1947.
2/ The 183,385 animal unit months of permitted use of the 1,065,361 acres of federal range exceeds the capacity of 164,909 animal unit months by 18,476 animal unit months, a permitted use of 11 percent over the capacity determined by range inventory presented in Table 4.

LAND RESOURCE CONDITION

Land resource condition class is a measure of the general state of health of the land resource in comparison with the best obtainable within the limitations of the site and soil. Definitions of land resource condition classes are described in detail in the appendix, Table I, Description and definition of land resource condition classes.

Lands in the best obtainable condition are graded excellent. They are virtually free of significant erosion with near climax vegetation and maximum productivity. Land in good condition shows minor soil loss or accumulation with only 10 to 25 percent departure from the maximum in quality and quantity of vegetation. Land in the fair condition class shows considerable moderate erosion and marked departure from the climax vegetation with production reduced 25 to 50 percent. Lands in poor condition have marked severe soil loss with quality vegetation of poor vigor far removed from the climax, their production being reduced more than 50 percent from the excellent class.

Conditions of the public domain and other lands in the area have been determined and are shown on the land use capability Map No. 3, and in Table 8. The map shows the condition class for each land use capability class by symbol as "G" good, "F" fair, "P" poor, there being no land in excellent condition. Table 8 is a compilation of the totals of each condition class within the eight land use capability classes further subdivided by ownership of the land involved.

Lands within the study area are 22 percent in good condition, 64 percent in fair condition and 14 percent in poor condition. No lands were classified as being in excellent condition. Condition classes of the federal public lands are 19 percent good, 65 percent fair, and 16 percent poor. Conditions of the land resources are poorest in the Badwater watershed where only ten percent of the federal public lands are classified as being in good condition. Conditions are virtually the same in the Dubois area. Federal public lands in the remainder of the area are classified as being 25 percent in good condition.

Table 8. - Land condition classes: acreage by land-use capability classes and by classes of land ownership within the report area of the Wind River Basin, Wyoming, 1946-47 (acres) 1/

Capability Class 2/	Good Condition 2/			Fair Condition 2/			Poor Condition 2/			Total Report Area		
	Federal Lands	Private and State Lands	All Lands	Federal Lands	Private and State Lands	All Lands	Federal Lands	Private and State Lands	All Lands	Federal Lands	Private and State Lands	All Lands
Classified:												
III (potentially irrigable Shoshoni & Badwater Units)	640	-	640	2,736	2,177	4,913	-	-	-	3,376	2,177	5,553
V	1,003	2,109	3,112	6,938	17,199	24,137	-	-	-	7,941	19,308	27,249
VI	146,672	132,070	278,742	419,905	246,794	666,699	89,131	48,677	137,808	655,708	427,541	1,083,249
VII	86,980	40,674	127,654	393,996	142,148	536,144	104,012	25,477	129,489	584,988	208,299	793,287
VIII	3,500	1,040	4,540	7,942	2,456	10,398	6,520	2,040	8,560	17,962	5,536	23,498
Total Classified	238,795	175,893	414,688	831,517	410,774	1,242,291	199,663	76,194	275,857	1,269,975	662,861	1,932,836
Unclassified:												
Croplands	-	-	-	-	-	-	-	-	-	55	39,067	39,122
Dubois area, state and private range land	-	-	-	-	-	-	-	-	-	-	110,882	110,882
Below high water levels Boysen and DuNoir Lakes	-	-	-	-	-	-	-	-	-	2,913	730	3,643
Townsites	-	-	-	-	-	-	-	-	-	-	893	893
Total Unclassified	-	-	-	-	-	-	-	-	-	2,968	151,572	154,540
Grand Total	-	-	-	-	-	-	-	-	-	1,272,943	814,433	2,087,376

1/ Compiled from inventories of the report area made by the Bureau of Land Management, Region III, Billings, Montana.

2/ See appendix for description and definitions of capability and condition classes

Table 9.- Land-use Capability and Suitability classes; acreages by classes of land ownership within the report area of the Wind River Basin, Wyoming 1946-47 1/

Capability Classification 1/ Class Number	Class Description and Suitability	Area of Public Land (acres)	Area of Public Land (percent)	Area of State and Private Land (acres)	Area of State and Private Land (percent)	Total Report Area (acres)	Total Report Area (percent)
Classified Cropland:							
3/I - III	Arable with irrigation-cultivated	55	2/	39,067	1.9	39,122	1.9
III	Adaptable for cultivation under irrigation	3,376	.2	2,177	.1	5,553	.3
Total arable land		3,431	.2	41,244	2.0	44,675	2.2
Classified Grazing Land:							
V	Grazing-proper use only requisite	7,941	.4	19,308	.9	27,249	1.3
VI	Grazing with restricted use	654,443	31.3	426,632	20.4	1,081,075	51.7
VI	Grazing and forest with restricted use	1,265	.1	874	2/	2,139	.1
VI	Forest of watershed value	-	-	35	2/	35	2/
	Total Class VI	655,708	31.4	426,541	20.4	1,083,249	51.8
VII	Grazing with special practices	561,158	26.9	198,240	9.5	759,398	36.4
VII	Grazing and forest with special practices	15,606	.7	7,451	.4	23,057	1.1
VII	Forest of watershed value-restricted cover or site	8,224	.4	2,608	.1	10,832	.5
	Total Class VII	584,988	28.0	208,299	10.0	793,287	38.0
Total Classified Grazing Land		1,248,637	59.8	655,148	31.3	1,903,785	91.1
VIII	Lacking in cover or use value	17,962	.9	5,536	.3	23,498	1.2
Total Classified Land		1,270,030	60.9	701,928	33.6	1,971,958	94.5
Unclassified Land:							
	Range land-Dubois area	-	-	110,882	5.4	110,882	5.4
	Lands to be inundated by Boysen and DuNoir Lakes	2,913	.1	730	2/	3,643	.1
	Townsites	-	-	893	2/	893	2/
Total Unclassified Land		2,913	.1	112,505	5.4	115,418	5.5
Total Classified & Unclassified Land		1,272,943	61.0	814,433	39.0	2,087,376	100.0

1/ Compiled from land-use capability inventories of the report area made by the Bureau of Land Management, Region III, Billings, Montana, 1947. See appendix for description and definitions of capability classes.

2/ Less than one-tenth of one percent.

3/ Undifferentiated classification.

LAND USE CAPABILITIES

Lands in the public domain area have been inventoried and classified according to the eight standard types of land use capability as shown on the land use capability Map No. 3. All of the eastern and southern parts of the area were classified, but only the Federal public land was classified in the western section around Dubois. 94 percent of the gross area is classified. Descriptions of capability classes are given in Table No. 8 and ownership are presented in Table 9, condition & suitability included.

Lands adapted to cultivation

Use of land for crops is limited to areas where irrigation water can be supplied as precipitation is insufficient for crop production. There are a few small meadow areas producing hay because of natural sub-irrigation. Lands capable of cultivation are divided into Classes I to IV, according to their quality. Lands in crop in the study area were not segregated between these classes in this inventory. Cropland in the study area is all irrigated covering 39,122 acres or 1.9 percent of the gross area of 2,087,376 acres. It is in Classes I to IV, most of it probably being Classes II and III. Most of the crop land is near Lander, 26,572 acres being located there along the Popo Agie River and its tributaries with some on Beaver Creek. There are 8,801 acres of cropland in the vicinity of Dubois along the Wind River. (North Fork) North Fork of the Wind River, Horse Creek and DuNoir Rivers. The rest of the crop land, 3,749 acres, is in the northeastern part of the area. Most of this crop land is located along Badwater Creek, with some on Bridger Creek, and small amounts on Dry, Hoodoo and Tough Creeks. All of the crop land is in private ownership except 55 acres of public domain land. Climatic conditions and distance to markets combine to largely limit crop land to hay and grain production. Alfalfa, with some mixed hay, yields $2\frac{1}{2}$ tons per acre annually. Small grains yield 35 bushels per acre. Cultivated land provides habitat for pheasants and grouse, providing some recreational suitability to the crop land area.

The crop land in the range area is utilized to produce hay, grain and irrigated pasture for feed to supplement forage on the range. Irrigation developments in the range area are small-scale shoe-string type units with simple diversions and short ditches of little capacity. Larger projects near Lander have ditches of large capacity up to ten miles in length. Farming without grazing land use is practiced on the larger projects, farm livestock and cash crops being the principal enterprises.

Lands under proposed irrigation developments within the study area were classified. All these lands were in Class III, covering 5,553 acres or 26 percent of the area. Class III land requires the use of intensive practice to maintain its production and to prevent undue soil loss. In this section soil or topography, usually both, limit the land to Class III. Some of these soils have a fine texture with poor permeability and high saline content. Other portions are so uneven that proper preparation for irrigation will be expensive and on some areas the slopes are so steep that irrigation will require special management to prevent erosion and to produce good crops. Class III is the lowest grade capable of constant

cultivation, Class IV being fit only for occasional cultivation, its preferable use being for perennial hay, pasture or woodland. Factors which lower classification of arable soils are: degree of susceptibility to and amount of erosion; surface or inherent interference such as stones or poor drainage, low fertility, shallow soil, salinity, or other inherent characteristics reducing permanent production unless treated. Any one deterrent factor will reduce land one class or two classes if sufficiently severe. Usually two coexistant detrimental factors operate to classify land as III rather than I.

The 5,553 acres of Class III land in the study area is susceptible to irrigation under the Shoshoni and Badwater unit developments of the Bureau of Reclamation. Location of this land is in an area two to seven miles north of Shoshoni and along Badwater Creek near Lysite. Ownership is 3,376 acres Federal and 2,177 acres state and private. Land in the Shoshoni unit will be suitable for all of the crops grown in the basin. Using the weather records of Shoshoni as a guide indicates that the unit may be better adapted to frost tender and long growing season crops than the balance of the basin, and that yields of hay, pasture and other crops may be greater because of the longer season. The Badwater unit is higher in elevation and probably has less favorable growing conditions, Class III land there probably being most suitable for hay and grain. Until irrigation water becomes available for this land, its utility is largely for grazing, with some recreation suitability derived from its use by antelope and other game animals.

Considering the soil welfare of the whole area, best use of the Class III land under the proposed irrigation development would be for supplementary feeds to provide an elastic cushion to protect both the range and livestock industry against the variable feed supply produced by the range land.

Lands adapted to grazing and forest

The three classes of land adaptable for grazing, Classes V to VII, are further classified on the land use capability Map No. 3 on the basis of the range management and conservation practice necessary to their proper use. Range management practices will vary according to the watershed significance, which is increasing, and the erosion situation, which is deteriorating on most of the area. It should provide for the proper season of use by the correct numbers and classes of livestock and big game and their proper distribution accomplished through range water development, salting, fencing and herding. The conservation and rehabilitation practices to be applied, however, will be primarily affected by the present physical condition of the land compared to its potentialities. Application of conservation practices will vary considerably between classes.

Class V land has good soil, is level in topography, and is not useful for cultivation because of lack of irrigation water, presence of surface obstacles, or poor drainage. Native vegetation on V land is above 30 percent in density with high production of forage. Proper stocking and

management are the only requisites for permanent use with continuing high production. Soil erosion is not a problem. There are 27,249 acres or one percent of Class V lands in the report area. They are located in the eastern part of the area and are primarily upland terraces or benches flanking intermittent drainage ways. There are 17,222 acres along the headwaters of Badwater Creek, of which only 4,328 acres are public domain. The remaining Class V land is located on Muskrat and Poison Creek watersheds, of which 3,613 acres is public domain. Class V lands are the best of the grazing lands, supporting a good stand of grass with sage brush. They also furnish some recreation as they contribute to the support of antelope, deer, and other game animals.

Class VI land is usually moderately sloping with soils of lesser depth and poorer quality than those on Class V land. The surface may be irregular with some stones or rocks. Land of this class usually has comparatively moderate to high density, 30 percent or more of vegetation and it produces good yields of forage. Moderate restrictions are requisite to maintain production and prevent erosion. Class VI land is moderately vulnerable to erosion and may show accelerated sheet erosion with occasional gullies.

Class VI lands cover slightly more than half of the study area, 1,083,249 acres. Class VI land dominates in the Badwater, Poison and Muskrat Creek drainages with less extensive areas in the Beaver Creek and Popo Agie drainages. There are 1,078,389 acres of Class VI land on these drainages, of which 650,848 acres are public domain. In the western portion around Dubois only Federal lands have been classified, 4,860 acres there being Class VI. Suitability of the Class VI land is virtually limited to grazing, only 2,139 acres being suitable for both forest and grazing. Class VI lands also are utilized by deer and antelope, and so contribute a recreational value.

Class VII land is usually steeply rolling to rough. They are usually the steeper lands above the Class VI lands. Level sandy areas may be in Class VII because of their texture, poor cover, and erosion hazard. Soils are usually shallow or otherwise restricted in quality. Vegetation is limited, the density being below 30 percent with poor production of forage. Severe restrictions are required for grazing use to maintain production and to prevent erosion. Class VII lands are readily susceptible to erosion and may show erosion to a severe degree.

Class VII lands cover 793,287 acres, which is 38 percent of the study area. Class VII lands dominate in the Beaver Creek and Popo Agie drainages and in the upper reaches of the Muskrat Creek drainage extending to Beaver Rim. Class VII lands also dominate the public domain land in the Dubois area, where only Federal public land was classified. Class VII public domain lands cover 584,988 acres or 28 percent of the study area. Class VII lands are nearly all suitable for grazing, lands of this type making up 36 percent of the study area. Class VII lands useful for both forest and grazing cover one percent of the area.

Lands primarily valuable for watershed, wildlife and recreation

Class VIII includes two types of land; land that is useless or nearly so because of its lack of cover, and land that is useless because its cover cannot be utilized due to its being inaccessible. Class VIII land is usually steeply rolling or rough with a soil which is shallow, undeveloped, or lacking. The only level areas are swamps, "alkali slicks", or areas without soil. Vegetation is lacking or virtually so unless it is inaccessible. The steep slopes are usually very susceptible to erosion and often show active geologic erosion. Class VIII lands have no commercial, grazing or forest value; they often possess limited watershed, wildlife and recreational value. They often present the most serious erosion problems, especially the steep slopes in badland areas.

Class VIII lands in the study area, 23,498 acres, are unproductive largely because of tight scabby soil, or rocky nature of the surface. There are 5,536 acres of public domain lands in Class VIII. Class VIII lands comprise about one percent of the study area, and are scattered over the area in small patches, with five areas over two square miles in size in the eastern portion. In the Dubois area Class VIII lands are steep badland slopes located along the north side of Wind River in the vicinity of Dubois. Class VIII lands have little value except for watershed, and even for that purpose their suitability is frequently negative as steep slopes in badlands are a source of silt.

The distribution of Federal, State, and private lands in the study area among the eight classes of land use capability is shown in Tables No. 8 and 9. Descriptions and definitions of the various land-use capability classes are found in Table II of the appendix.

LAND USE SUITABILITY

Land-use suitability refers to the best use of the land under the prevailing physical and economic conditions. Lands may be suitable for farming, grazing, forest, wildlife, recreation, watershed and other special uses. Land-use suitability for each of the land-use capability classes are summarized in Table 9, Land-use capability and suitability classes; acreages by classes of land ownership within the report area of the Wind River Basin, Wyoming, 1946-47. The table also differentiates such suitabilities by classes of land ownership.

Land-use suitability and proposed land ownership adjustment Map No. 5 illustrates four principal classes of land-use suitabilities, namely: lands primarily suitable for cultivation, constituting 44,675 acres; lands primarily suitable for forest and watershed, approximately 81,000 acres; lands primarily valuable for watershed, wildlife and recreation, approximately 26,000 acres; lands primarily suitable for grazing and watershed, approximately 1,936,000 acres.

Some lands, of course, are suitable for other multiple-purpose uses such as mining, oil developments, cabin sites, target ranges and other special uses. The relative significance of the various land-use suitability classes strikingly depicts the dominant role which the extensive grazing and watershed lands play throughout the report area.

As shown on Map No. 5, public domain in some areas have negligible or no public values and are, therefore, best suited for private management and ownership. Some areas are suitable for management under state programs. These programs are discussed in further detail in the problem section of the report.

PROBLEMS PRESENTED WITHIN THE REPORT AREA AND PROPOSALS FOR THEIR SOLUTION

The problems of the public lands within the Wind River Basin are fundamentally those which are related to the land resources, their condition and their utilization. On the preceding pages, these public land resources have been described and appraisal has been made of their condition and utilization and their significance in the overall basin program. The maps which accompany this report delineate in cartographic form, the location of these resources, their condition and utility, It is the purpose of the section which follows to describe and locate the problems, to propose a remedy therefor and to outline the costs and benefits of such treatment and practice.

Problem 1. Watershed impairment and resultant siltation and sedimentation of streams and reservoirs.

The Big Horn River is acknowledged to be one of the greatest silt contributors to the Yellowstone River, which in turn is known to be the most important offender from the standpoint of siltation and sedimentation within the entire Missouri River Basin. The watershed of the Wind River constitutes 36 percent of the Big Horn drainage and silt production from this area is unusually great. Silt measurements at Thermopolis, for example, disclose that the mean average silt load for the period of record in 1946 was 17,300 tons daily, the range being from 1,160 to 203,000 tons daily. Silt measurements at this station virtually represent the run-off of the basin as very little of its drainage area of approximately 8,000 square miles is located below the site of the Boysen Dam. 1/ Reduction of reservoir siltation may prove to be one of the most valuable ways in which the upstream soil and moisture conservation program of the Bureau of Land Management can contribute to the success and longevity of the Boysen Reservoir and other reclamation developments in the Wind River Basin.

Erosion, the removal of "soil" by wind and water, is taking place on all parts of the report area in some degree or other. Natural or normal erosion, as distinguished from accelerated erosion, is the slow continuing process of surface planation. Where natural conditions are undisturbed by man's activities, the intensity of the normal or geologic erosion is determined chiefly by topography, geology, soils, climate and vegetative cover. Through the vehicle of wind and water, natural or

1/ Preliminary data for the period March 15 to September 30, 1946. Daily suspended sediment concentration in parts per million and discharge in tons per day of Big Horn River at Thermopolis, Wyoming; U. S. Department of Interior, Geological Survey, Water Resources Branch, Billings, Montana, 1948. The concentration of suspended material varies from 616,616 to 19,700 parts per million, the mean average being 2,800 parts per million. Were this silt load to be converted into 40 ton carloads, the amount of run-off silt varies from 29 cars to 5,075 carloads per day, the average being 432 cars daily. If these cars were made up in 50 car trains, there would be over 101 trains representing the maximum flow, a short train of 29 cars a minimum with 9 trains being the daily average for the period.

geologic erosion is being carried on at such a rapid rate in some portions of the report area that it prevents the formation and development of soils. Such areas are not extensive, fortunately, but erosion upon these lands is so great that their importance as a watershed problem is highly magnified. Only on such broken areas where soils have never formed and the comparatively inert geological material is extremely erosible and unstable and vegetation is sparse or lacking, is normal erosion sufficiently rapid to be noticeable. Accelerated erosion, on the other hand, occurs when natural conditions are disturbed as a result of man's activities or as a result of fire or by marked changes in climatic conditions. If there has never been a vegetative cover on an area, then the processes are normal geologic erosion. If, however, there has been a canopy of vegetation which has been destroyed as a result of human practices, then the erosional processes would be classed as accelerated. Accelerated erosion, therefore, may be described as the wearing away of the soil as a result of man's activities, faster than it is replaced by natural processes. It has been described as being no more nor less than man's efforts to take something for nothing from the soil. As the inexorable creditor, it is nature's method of collecting a debt long overdue. Three general classes of the processes of accelerated soil erosion are recognized. The least conspicuous, although the most extensive, is sheet erosion, recognizable in the exposure of roots of plants, in the lower productivity of the site, and in the insidious lateral movement and gradual disappearance of the topsoil. Wind erosion assumes its most spectacular form as dunes and finally accelerated erosion assumes its most conspicuous and detrimental form as deep gullies.

In order to provide a basis upon which to consistently classify the character, degree and extent of soil erosion in the report area and to show the relationship of such erosion to the various classes of land-use capabilities and suitabilities, to topographic conditions, to vegetative cover and to present uses to which the lands are put, the following procedure was followed in making surveys of soil erosion conditions. The three general classes of soil erosion, which are recognized in this survey, are sheet erosion, wind erosion and gully erosion. Since much of the eroded and eroding lands suffer from a combination of the three principal types of erosion, rather than from one type alone, such combinations are indicated by descriptive numerical symbols on the erosion condition Map No. 2. As described and defined in Table III, Description and definitions of the erosion condition classes, five erosion degrees are used to represent the predominating combination of erosion conditions for a particular area. Thus, the numerical symbol 3-1-3 designation would indicate moderate to severe sheet erosion; none to slight wind erosion and occasional deep gullies. The three figures are used in each of the delineated areas on the erosion map, the first of the series showing the relative degree of sheet erosion, the second the amount of wind erosion and the third the comparative frequency and depth of gully erosion. The three figures show graduating degrees of erosion conditions ranging from Class 1, none to slight to Class 5 critical to extreme as listed with the total areas of each classification group in Table 10. The location of erosion classified

by the five degrees is shown on the erosion condition and proposed improvement Map No. 2. The extent of erosion is shown graphically in Figure No. 2. Erosion is further analyzed according to degree within each type in Table 11. In addition, soil erosion conditions were factors considered in the classification of land-use capability, land-use suitability and conditions of land resources.

An analysis of the erosion condition map for the report area reveals that the largest area of severe erosion is found in the uplands of Muskrat, Deer and Canyon Creeks, comprising 220,000 acres. Sheet erosion is severe to critical, wind erosion moderate to severe and shallow gullies are frequent. A similarly classified area is located on the headwaters of Alkali Creek near Arminto. This area comprises 71,000 acres. A third area of severe erosion comprising 35,000 acres with the same classification except that wind erosion is only slight to moderate, extends 26 miles eastward from Shoshoni along the south watershed of Badwater Creek. The Badlands in the vicinity of Dubois presents spectacular erosion embodying 10,000 acres ranging from critical to extreme accelerated gully erosion with slight to moderate wind erosion. Smaller areas of this class of erosion are located 10 miles north of Shoshoni and in small bodies of steep clay lands scattered over the eastern portion of the area. There are 9,600 acres of active small sand dunes on the divide between Poison Creek and Muskrat Creek classed as severe to critical wind erosion, moderate to severe sheet erosion with occasional shallow or deep gullies occurring at intervals of more than 100 feet apart. There are 33,000 acres of sandy land in this vicinity which are moderately to severely eroded by wind. It is important that a good vegetation cover be maintained to prevent a wholesale recurrence of migratory dunes. An irregular area of approximately 16,000 acres of steeply, rolling, gravelly land occurs northwest of Dubois with moderate to severe sheet and wind erosion with frequent shallow gullies characterizing the erosion situation.

Distribution of erosion by classes and degrees is summarized in Table 10. The largest class in the report area covers nearly 1,000,000 acres, or 46 percent of the area. Land in this class has moderate to severe sheet erosion, slight to moderate wind erosion and occasional shallow gullies, the symbol designation of this class being 3-2-3.

One-fourth of the report area shows severe to extreme erosion conditions in one or more of the three classes, sheet, wind or gully. This quarter of the area is made up of 24 percent severe to critical and one percent critical to total destruction. Moderate to severe erosion in at least one of the three categories make up nearly 61 percent of the area. Slight to moderate erosion, as the maximum degree in at least one class of erosion, makes up only 14 percent of the area. Figure No. 2 graphically summarizes the extent of erosion within the report area.

Gully erosion with attendant banks sloughing is perhaps the most spectacular type of erosion in the report area. On 23 percent of the report area active, shallow gullies are frequent occurring at intervals of less than 100 feet apart. Frequent deep gullies comprise one percent

of the area while the bulk of the area is characterized by occasional, shallow or deep gullies occurring at intervals greater than 100 feet apart, and comprise 61 percent of the report area. Occasional active gullies usually shallow, make up 13 percent of the area while no active gullying takes place on the remaining 2 percent of the area. The larger intermittent drainageways have in most cases, cut steep bank gullies throughout the area. The depth of these gullies vary from a few to 50 feet. Meandering of the stream in the bed of the gully walls adds hugely to the stream bed silt load derived from rapid run-off and flood flows from slopes which are depleted of vegetation. Likewise, gully headcuts and bank cutting of lateral tributaries contribute no small amount to the stream bed silt load. Best examples of gully erosion are found on the larger intermittent streams which include Poison Creek, Muskrat Creek, Frazer Draw, Conant Creek, Oil Mountain Draw, Logan Creek, Carter Draw, Kirby Draw, McTurk Draw, Sawmill Creek, Rattlesnake Draw, Government Draw and Sand Draw. The lower intermittent portions of Badwater Creek, Beaver Creek and Twin Creek and most lateral tributaries display serious erosion with consequent large silt contributions. Geological erosion on the steep slopes is more rapid than the formation of soil resulting in frequent deeply dissected gullies which makes a spectacular erosion feature as exhibited in the Badlands near Dubois. While such areas comprise but a small segment of the report area, the geologic processes of erosion, are highly significant and they exert a considerable influence in watershed conditions. Gullies occurring on range lands are almost invariably symptoms of range misuse and even more serious erosion will follow unless control measures are instituted. Erosion problems are attributable primarily to steepness of slopes, the high erosability of much of the soils, sparsity of the vegetative cover caused in part by paucity of precipitation, depletion of forage due to intensive trailing and grazing by livestock and excessive concentration of livestock near watering places, rapid run-off from melting snows and the occasional torrential showers occurring in the spring and summer months. With some exceptions, the least eroded areas are located at the higher elevations of the report area.

Wind erosion, while not as important as water erosion in the report area, is nevertheless a problem of some magnitude in localized areas. For the report area as a whole, only about 19 percent is in a severe or critical stage and much of this area is in combination with severe stages of sheet erosion, the principal causative factor. The maintenance and betterment of the range vegetative cover in this dry region will reduce the adverse effects of accelerated sheet and wind erosion.

The most serious sheet erosion conditions are found on heavy clay or adobe soils which are ordinarily deficient in humus, are more or less alkaline, do not readily absorb water and support a comparatively meager stand of vegetation. Under the influence of heavy summer rains, they erode at a rapid rate. Moderate to severe sheet erosion occurs on 54 percent of the report area, severe to critical on 18 percent, critical to extreme on one percent, while slight to moderate sheet erosion occurs on 27 percent of the report area. The intensity of

accelerated sheet erosion is generally in direct proportion to the depletion or reduction of vegetative cover. The principal factor modifying or disturbing the protective vegetative cover is heavy grazing in the early spring when range plants are making their initial and maximum growth. Early spring use has been a major cause of range deterioration and has permitted continuation of much of the accelerated erosion on the more unstable soils of the report area. Tho plant associations indigenous to the area are usually capable of surviving relatively long periods of drouth in any one season or over a number of dry years. During such periods, the plants make very little growth or lie dormant until moisture and favorable temperature is obtained. In favorable years, vegetative production may be many times that of years with limited precipitation. The bulk of plant growth is usually made in the spring and early summer. Allowance for proper utilization must be made to permit the spring and early summer plant growth in order that maximum effectiveness is maintained to control accelerated erosion. Concentration of livestock on driveways and around surface water supplies has also contributed to the problem of severe damage to the vegetation and soil. The malpractice of maintaining sheep bedgrounds on the same area for long periods of time during the winter grazing season, has created problems of erosion and made such areas extremely susceptible to both wind and water erosion.

Irrigation, while necessary to crop production in this climate because of the limited rainfall, is none the less a potential erosivo process and may create serious erosion on the finer soil types. Irrigation produces a great deal of silt in the waste water of the irrigation developments in the basin. Soil conditions and types impose marked restrictions on the development of irrigated land especially those soils which are fine textured, saline or located on sites with inherently poor drainage. These factors combined with a short growing season, relatively cheap water and comparatively low valued crops, have resulted in careless irrigation practices which include overuse of water. Such practices have created an undue amount of seeped and alkali land on some irrigation projects in the report area and elsewhere in the basin.

Sedimentation is a problem of direct concern in management of the public domain lands. The rapid rate of sedimentation in existing small surface reservoirs in upland eroded areas has very often quickly reduced their value for livestock watering purposes.

FIGURE 2. EXTENT OF EROSION CONDITIONS BY AREA CLASS AND DEGREE OF EROSION IN THE REPORT AREA,
WIND RIVER BASIN, WYOMING

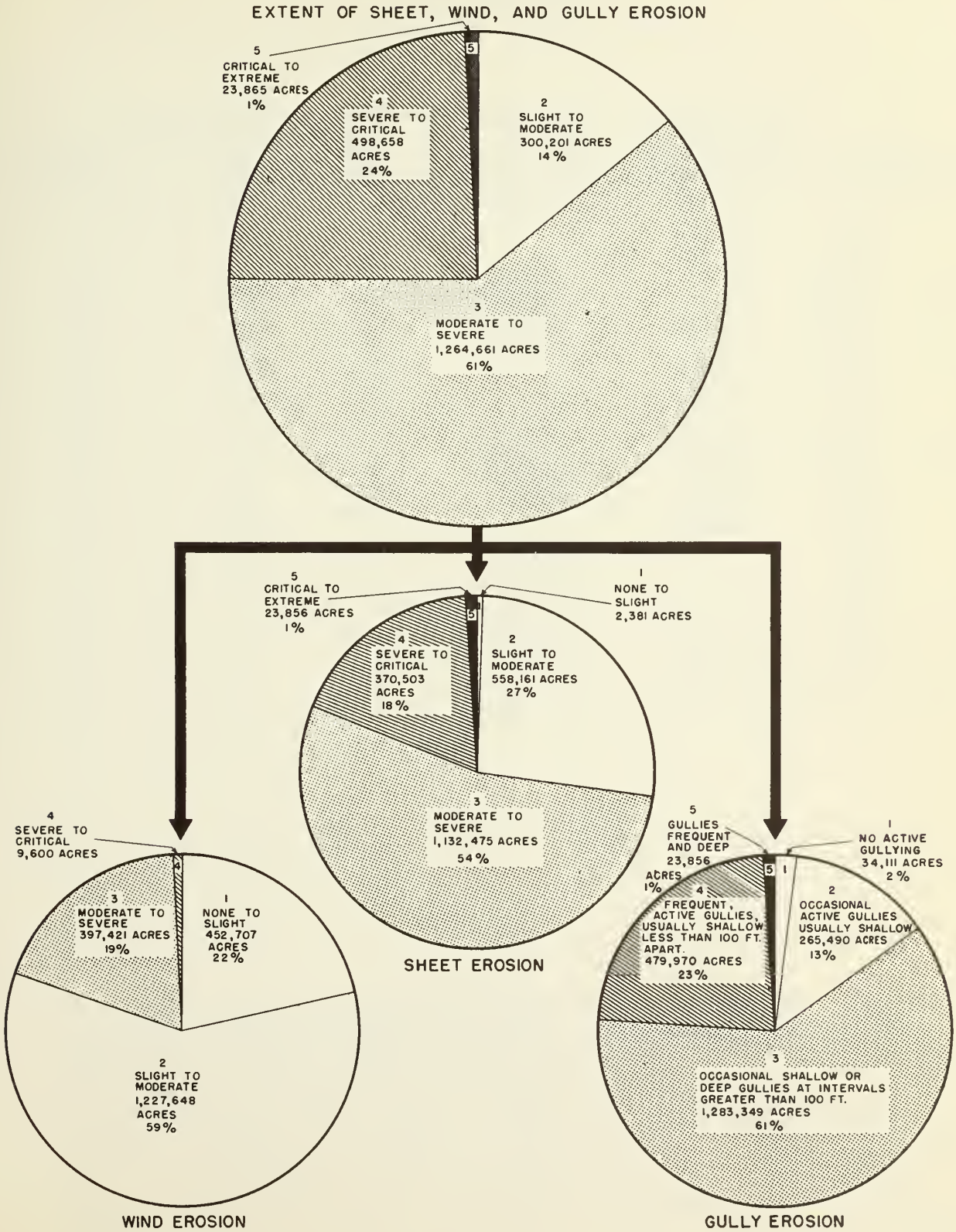


Table 10. - Distribution of erosion classes as inventoried on the report area of the Wind River Basin, Wyoming, 1948 1/

Class of Erosion 2/			Area east and south of Reservation	Dubois area west of the Reservation	Total	
Sheet Erosion	Wind Erosion	Gully Erosion	(acres)	(acres)	Report (acres)	Area (percent)
1	1	2	-	2,381	2,381	.1
2	1	1	34,401	310	34,711	1.7
2	1	2	193,366	-	193,366	9.3
2	2	2	51,161	18,582	69,743	3.3
2	1	3	211,828	-	211,828	10.1
2	2	3	-	29,155	29,155	1.4
2	3	3	-	19,358	19,358	.9
3	1	4	10,421	-	10,421	.5
3	2	3	929,051	40,803	969,854	46.5
3	2	4	82,931	7,087	90,018	4.3
3	3	3	33,431	1,035	34,466	1.7
3	3	4	-	18,116	18,116	.9
3	4	3	9,600	-	9,600	.5
4	2	3	9,088	-	9,088	.4
4	2	4	35,934	-	35,934	1.7
4	3	4	312,023	13,458	325,481	15.6
5	2	5	13,400	10,456	23,856	1.1
1 - 5	1 - 4	1 - 5	1,926,635	160,741	2,087,376	100.0

1/ Compiled from inventories of the report area made by the Bureau of Land Management, Region III, Billings, Montana. The Erosion Condition Map, , delineates the areas of each of the erosion classes listed in this table.
2/ Definitions of degrees of erosion are given by classification number in the appendix. Class 1 is none to slight; 2 is slight to moderate; 3 is moderate to severe; 4 is severe to critical and 5 is total destruction.
3/ Gully erosion is classified by depth and frequency of gullies. Class 1 has no active gullying; class 2 has occasional active gullies, usually shallow; class 3 has occasional shallow or deep gullies at intervals greater than 100 feet; class 4 has frequent active gullies, usually shallow at intervals of less than 100 feet and class 5 has frequent deep gullies.

Table 11.- Summary of erosion conditions by types and degree in the report area of the Wind River Basin, Wyoming, 1948 1/

Degree of Erosion		CLASS OF SOIL EROSION							
		Sheet Erosion		Wind Erosion		Gully Erosion		Maximum degree of erosion, all classes	
Class No.	Class Description 2/	Acres	Percent	Acres	Percent	Acres	Percent	Acres	Percent
1	None to slight	2,381	3/	452,707	22	34,711	2	-	-
2	Slight to moderate	558,161	27	1,227,648	59	265,490	13	300,201	14
3	Moderate to severe	1,132,475	54	397,421	19	1,283,349	61	1,264,661	61
4	Severe to critical	370,503	18	9,600	3/	479,970	23	498,658	24
5	**Critical to extreme**	23,856	1	-	-	23,856	1	23,856	1
Total		2,087,376	100	2,087,376	100	2,087,376	100	2,087,376	100

1/ Compiled from erosion inventories of the report area made by the Bureau of Land Management, Region III, Billings, Montana, 1948.

2/ Class descriptions and definitions are given in detail in the appendix. Gully erosion is classified by depth and frequency of gullies. Class 1 has no active gullying; class 2 has occasional active gullies, usually shallow; class 3 has occasional shallow or deep gullies at intervals greater than 100 feet; class 4 has frequent active gullies, usually shallow, at intervals of less than 100 feet; and, class 5 has frequent deep gullies.

3/ Less than one percent.

The principal solution to the problem associated with watershed impairment is the application of good range management and conservation practices over the entire area by the livestock operators and all others who utilize or administer the area. The conservation practices which are needed in the report area, are those which will facilitate the orderly development of the Wind River Basin. Proper land-use will greatly reduce accelerated wind and water erosion by maintaining suitable plant cover. It may be necessary to restrict and even curtail use in the more severely eroded areas until such time as the vegetative cover has again become established. In addition to correcting such maladjustments in operating use such as improper stocking, inadequate distribution of livestock, incorrect seasonal use and lack of such range-use facilities as fences, corrals, wells and spring developments a program of conservation practices is proposed to control erosion in the more critical areas. The proposed structural devices and conservation practices will in themselves retard run-off and thereby alleviate the erosion problem. Such rehabilitation measures are shown on the proposed improvement map No. 2. By and large, watershed protection in the report area of the Wind River Basin is basically a problem of management of the range resources. The reduction of siltation and sedimentation in the perennial and intermittent streams and in the existing and proposed reservoirs is dependent in a large part upon the proper use of the range, 61 percent of which are comprised of public domain lands. The long range improvement plan proposed in this report includes as its main objective the practical management of range resources and adequate structural installations to insure the rehabilitation of watershed conditions on the public domain lands. The proposed rehabilitation program will in its full development make the public domain lands more beneficial to the users and thereby not only promote the welfare of such users but increase the economy and social welfare of the basin as well. The program includes water and silt control structures, surface reservoirs for livestock water, spring developments, well drilling, provision for tanks, troughs and windmills, fencing, truck trails, cattle guards, rodent control, brush and poison plant removal.

The activities in petroleum and gas exploration and developments have also been a cause of accelerated erosion in some portions of the report area. Roads have been bulldozed in many parts of the area, the surface vegetation has been removed and has thus provided for the possible development of detrimental gullies and resultant increased burdens of silt in adjacent drainageways. Roads and trails should be located and constructed in such a manner that they do not accumulate run-off water. Temporary roads should be provided with cross drainage so that when they become abandoned their bared surfaces do not become potential gullies. Mineral and petroleum exploration and development operations should be conducted so that they interfere as little as possible with other uses of the land and so that they do not unduly contribute to the erosion problem. In keeping with this policy, a code of operational and conservation ethics has been adopted by various oil and gas companies. The details of this program were worked out by the Rocky Mountain Oil and Gas Association in collaboration with the Bureau of Land Management. Under this code of ethics, operations have already

improved in charactor and tho continued careful adherence to the code should result in a minimum amount of damage to the soil, water and vegetative resources of the report area.

Extensivo improvements have been made on the area especially on private land. Such improvements range from relatively large irrigation projects to simple stock water developments. Improvements on private range land were installed by livestock operators largely under the Agricultural Conservation Program of tho Production and Marketing Administration and the Soil Conservation Districts. Most of these improvements have been livestock water reservoirs. A considerable area of range land has been fenced by livestock operators and thoy have also developed a number of wells and springs on the report area.

Under Section 4 of the Taylor Grazing Act, qualified livestock operators are permitted to construct and maintain fences, wells, reservoirs and other improvements necessary to the care and management of the permitted livestock on public domain lands. Most of such improvements now under permit are found on public lands in the Wind River Grazing District. Fences and stock water reservoirs comprise the greater part of such improvements, followed by such varied structures as corrals, lambing sheds, shearing pens, spring and well developments, and barns. A number of existing developments have not as yet been placed under permit.

The Bureau of Land Management has constructed 185 stock water reservoirs on public domain lands. A summary of these and other completed range improvements are shown in Table 12. The cost of programs for the operational phases of range improvements such as wells, reservoirs and fences have, to some extent, been borne by the range users, but the larger part of the cost has been borne by range improvement and Soil and Moisture Conservation funds of the Bureau of Land Management. The program of soil and moisture conservation conducted by the Bureau of Land Management is a continuing activity authorized under tho provisions of the Act of April 27, 1935, (49 Stat. 163), often referred to as the National Soil Conservation Act. This Act as amended provided, in part,

> ". . . it is hereby recognized that the wastage of soil and moisture resources on farm, grazing, and forest lands of the Nation, resulting from soil erosion, is a menace to the national welfare and that it is hereby declared to be the policy of Congress to provide permanently for the control and prevention of soil erosion and thereby to preserve natural resources, control floods, prevent impairment of reservoirs, and maintain the navigability of rivers and harbors . . ."

By the provisions of Section 6, of Government Reorganization Plan No. 4, (54 Stat. 1234 and 1235), April 11, 1940, all functions under the 1935 Act relating to soil and moisture conservation operations on the public domain lands under the jurisdiction of the Department of the Interior were transferred to this Department from the Department of Agriculture.

This section of the Plan reads as follows:

> "Certain functions of the Soil Conservation Service transferred.--The functions of the Soil Conservation Service in the Department of Agriculture with respect to soil and moisture conservation operations conducted on any lands under the jurisdiction of the Department of the Interior are transferred to the Department of the Interior and shall be administered under the direction and supervision of the Secretary of the Interior through such agency or agencies in the Department of the Interior as the Secretary shall designate."

The clause "on lands under the jurisdiction of the Department of the Interior" has been interpreted (Acting Solicitor's Opinion M. 30997 of October 25, 1941), to mean that the Secretary of the Interior has authority to perform soil and moisture conservation measures on Federally owned or controlled lands under the jurisdiction of the Department of the Interior and also, on any other lands, with the consent of the owners, where the primary purpose is the protection and benefit of Federally owned or controlled lands under the jurisdiction of the Department of the Interior. The soil and moisture conservation program of the Bureau of Land Management is designed to accomplish the purposes of the 1935 Act as it may apply to the public land in the jurisdiction of the Bureau. Conservation planning and operations are organized on the basis of project areas. Each such area is a unit of land on which rehabilitation and conservation treatment is essential to the reduction and prevention of critical erosion and the wastage of water resources. All of Wind River Grazing District within the report area is included in approved Soil and Moisture Conservation Project areas. The soil and moisture conservation work performed upon the public lands consists primarily in the use of proven, practical devices to slow down and stop further soil and water losses, and of procedures involving management and use of the rehabilitated land to prevent a recurrence of the erosion condition. The reduction in siltation, the decrease in floods, and the checking of erosion through use of these devices and procedures is accompanied by improvement in range conditions and increased forage supplies.

Major improvements proposed by the Bureau of Land Management are designed to reduce erosion, siltation and sedimentation and to promote the soil and vegetative welfare of the report area. Waterspreading, check dams, silt detention dams, tree planting, stream bank protection and range revegetation are planned in the areas of most severe gully erosion. Most of this work is in the watersheds of Muskrat, Deer, Canyon and Alkali Creeks and extending along the south watershed of Badwater Creek. Improvements planned for the balance of the area, most of which is less severely eroded, are largely confined to the construction of boundary and drift fences and the development of additional livestock waters in the forms of wells, reservoirs and spring developments. Additional sources of livestock water will improve range utilization by distributing livestock and reducing concentration of livestock and trailing to water. Earth fill silt detention dams and diversion dams with associated waterspreading systems are planned for construction to reduce the silt load in the intermittent drainageways and permit the controlled spread of flood waters over adjoining range lands and thus incidentally

produce more range feed. Range reseeding and other treatments such as contour furrowing will augment such conservation practices. Sites for 47 large earth-fill dams have been selected which will intercept flood waters and permit the gradual draw-down of stream flow and collect silt in the storage basins and are described in Table 13. Fenced desilting exclosures are planned for development in the drainage channels above some of these dams. Ten of the larger and more important silt detention dam sites are described more fully in the following paragraphs.

A proposed earth fill dam, located about the center of Sec. 4, Township 35 North, Range 93 West where Conant Creek, Oil Springs Draw and Hawkins Draw enter Muskrat Creek, will control the water entering Muskrat Creek at this point. The drainage area is roughly six townships in extent. The headwaters are in the very steep country of Beaver Rim where heavy run-off during the spring thaw and heavy seasonal rains occur. According to old-timers, the point of confluence of Conant Creek and Muskrat Creek has shifted upstream about 1,200 feet in the last 35 years. It is estimated that 50,000 cubic yards of soil has eroded from this limited area during that period of time. A wide, sandy flat now replaces the wedge of land removed. The present bed of Muskrat Creek at this point now exceeds 450 feet in width. Alkali sacaton, saltgrass and some shrubs are beginning to stabilize some of the less disturbed areas in the sandy-bottomed draw. A dam, provided with a draw-down tube at this point, will permit the formation of a sub-irrigated meadow for a distance of several miles downstream. An old irrigation ditch can be utilized to carry off a large part of flood peak flows and spread water over about four or five sections of sagebrush covered land located about 3 miles below the proposed reservoir. This site should have high priority if engineering features are found feasible. The structure will contain an estimated 58,000 cubic yards of earth fill and will have a storage capacity estimated at about 240 acre feet.

Another dam site, located on Muskrat Creek in Sec. 26, Township 34 North, Range 91 West, has a natural spillway which will permit diversion of flood water into a dry lake and located about a mile and one-half upstream from the site of the dam. If the reservoir should ever fill and overflow, a spreading area of about 400 acres would become available. It is doubtful, however, if this situation would prevail very often, since the storage capacity would be extremely large, and the provision for a draw-down tube in the dam itself would permit the reservoir to empty between storms. The dam would contain about 75,000 cubic yards of earth fill with an estimated storage capacity of 450 acre feet. The reservoir would permit the downstream stabilization of the channel banks, and thus reduce siltation caused by peak flood flows.

A third dam site is located in the NW$\frac{1}{4}$NE$\frac{1}{4}$ Sec. 28, Township 33 North, Range 91 West. This site would supplement the previously described projects and permit the handling of water coming from a lateral tributary, such water to be utilized for spreading purposes. The dam would contain approximately 70,000 cubic yards of earth fill and would enable the spreading of water on about 200 acres of nearby range land. The estimated storage capacity of this reservoir is 300 acre feet.

Another dam site for retention of silt is located in the NW¼NW¼ Sec. 1, Township 35 North, Range 93 West. Located in a rather narrow portion of the Muskrat Creek drainage, the dam contains about 75,000 cubic yards of earth fill. Flood waters could be spread over about 600 acres with a minimum amount of construction work. A natural spillway is available which would require very little alteration. A draw-down tube is recommended for this site. The cost of the dam would be approximately $15,000. The storage capacity of the reservoir is estimated at 400 acre feet.

An alternate site to the above proposed dam is located in the NW¼NE¼, Sec. 6, Township 36 North, Range 93 West. The lower-most downstream site on Muskrat Creek, it is perhaps the least desirable location from an engineering standpoint because an expensive spillway would be required to assure adequate stabilization. A dam in this location would contain approximately 75,000 cubic yards of earth fill with a reservoir storage capacity estimated at 400 acre feet.

Another site for a silt detention dam is located in Sec. 9, Township 32 North, Range 95 West and would contain about 30,000 cubic yards of earth fill. It is the only location in Little Sand Draw on which a large reservoir site is considered feasible. The storage capacity of the reservoir is estimated at 2,000 acre feet, and from this standpoint, it is a very desirable location. A draw-down tube should be installed in this reservoir. Water spreading is not considered feasible.

A location for a silt detention reservoir in Big Sand Draw is found in about the center of Sec. 27, Township 33 North, Range 95 West. The dam would contain approximately 30,000 cubic yards of earth fill. Water could be spread over an area of about 400 acres of range land. The headwaters of this drainage comprise the very steep portions of the Beaver Rim country and consequently, the run-off is expected to be heavy. The estimated storage capacity is about 1,800 acre feet.

The drainage area known as Horseshoe Draw contains a desirable site for a dam in the SW¼NW¼ Sec. 15, Township 34 North, Range 92 West. The proposed earth fill structure will contain approximately 35,000 cubic yards. The drainage area above this site is estimated at about sixteen square miles. Flood waters could be diverted and spread over an area of about 400 acres of range lands. A draw-down tube should be installed. The storage capacity is estimated at 150 acre feet. Tree planting is considered feasible below this reservoir site.

A silt detention dam site is located on Dry Cheyenne Creek in Sec. 14, Township 36 North, Range 94 West. The sam will contain about 75,000 cubic yards of earth fill although the bottomlands of this draw are comparatively well covered with grass. The stream channel is constantly shifting because of peak flows during summer storms. Bank cutting and the breakdown of the grass cover are the principal problems in this area. The storage capacity of the proposed reservoir is estimated at 400 acre feet, and water spreading is feasible on approximately 100 acres of adjacent range lands.

A silt detention structure is proposed in Deadman's Draw, the site being located in the center of Sec. 9, Township 37 North, Range 91 West. The drainage area above this site is estimated to comprise six square miles, the principal characteristics of which are the steep badlands which carry a heavy silt load after each storm. The main draw, as a result, is cutting very badly. This structure will contain approximately 45,000 cubic yards of earth fill with no possibility of water-spreading. No draw-down tube would be necessary in this location, although it might be well to consider this feature in connection with irrigation of tree plantations below the dam. The storage capacity of this reservoir is estimated at 125 acre feet.

Smaller silt detention dams will be constructed at 435 locations. The large number of livestock water reservoirs which have already been constructed and the additional ones which will be built are in themselves effective silt traps and stream flow regulators. The proposed waterspreading systems will retain silt, keep water on the range land, produce additional range feed and control erosion. Tree plantings are proposed to control bank erosion along several critical silt producing streams. Seven major sites were selected which are for stream bank stabilization through tree planting. These sites and the approximate area involved and plantings to be accomplished together with the estimated cost are as follows:

Site	Miles of Stream Channel	Number of Trees	Total Estimated Cost
Muskrat Creek	23	230,000	$ 14,000.00 1/
Beaver Creek	9	85,000	3,500.00
Big Sand Draw	5½	55,000	2,300.00
Little Sand Draw	6	75,000	2,500.00
Carter Draw	4½	45,000	2,000.00
Total	48	490,000	24,300.00

1/ This amount includes $4,000 for protective fencing.

Most of these tree plantation areas are situated along principal drainage channels and in connection with the large silt detention dams planned under the flood control feature of this project.

Sites for the planting of trees to control gully erosion are located primarily in drainages which have characteristically wide sandy drainageways, all of which are intermittent drainages. The debris and silt deposited in areas of overflow indicate an extremely heavy silt load during the spring thaws and during the periods of heavy seasonal rain. Tree plantings, alone, perhaps will not solve the problem because of the size of the watershed, especially on such large drainageways as the Muskrat and Beaver Creeks. The planting of trees below the proposed silt detention reservoirs, especially those where a draw-down tube will be installed, are considered to be the best site locations for the maximum results.

Carter Draw has been selected as an ideal area for experimental plantings because it is relatively short and no large mechanical structures such as silt detention reservoirs are needed. There are several small stock water reservoirs located on the smaller lateral tributaries of this drainageway and peak flood flows are at the present time largely controlled. Carter Draw is especially desirable for planting purposes at the present time because the operator who uses this area has sold the larger part of his livestock, and consequently, grazing by domestic livestock will not pose a problem during the near future. If light use can be assured, it will not be necessary that this tree planting demonstration be fenced. Rodent and game populations do not present a problem. The area is easily accessible for observation of the tree plantation results. The drainageway heads in the report area in Sec. 10, Township 33 North, Range 95 West, and runs in a northwesterly direction to Sec. 30, Township 34 North, Range 95 West, and thence into the Wind River Indian Reservation. The watershed comprises an area of about twelve square miles and consists principally of sagebrush with an understory of grasses containing such specie as blue grama, Poa, Carex, etc. The density is estimated at about .25. The soil moisture at the bottom of the drainageways is seldom greater than 18 inches below the surface so sufficient moisture should be available for trees and shrubs to become firmly established. The land within the drainage area is mainly in Capability Class VII and the condition is considered fair. The soils within the drainage vary from a heavy clay to a sandy clay loam. The present channel is about 150 feet wide at the downstream point where it enters the reservation and narrows to about 50 feet in Sec. 4, Township 33 North, Range 95 West, where the trial plantings are to be placed. The drainage is a wide, sandy-bottomed, meandering and intermittent stream characterized by alternately cut banks averaging from 3 to 6 feet in height.

Downstream from the proposed planting area the Bureau of Indian Affairs have previously made tree plantings within the reservation. The plantings were made in 1941 in order to determine what specie were adaptable to the area. Little consideration was given to erosion control, since some of the tree plantings have induced bank cutting in parts of the area. The Bureau of Indian Affairs planted Russian olive, cottonwood, willow, skunkbush, caragana and ash. Several other specie were also reported planted. The Russian olive made by far the best growth and reproduction. The cottonwood was perhaps next, and willow a poor third. The willows, however, were planted in less desirable locations where heavy silting occurred. The caragana and skunkbush have survived but are making little growth with no reproduction in evidence.

On the headwaters of the same drainage in Sec. 10, Township 33 North, Range 95 West, the Soil and Moisture Branch of the Bureau of Land Management planted 5,000 trees in April, 1948. Transplantations consisted of Russian olive, caragana and elm. At present, there is about 85 percent survival. However, 90 to 95 percent of the elm had been badly damaged by rodents, while none of the Russian olive and only a few of the caragana plantings show any sign of rodent damage. This plantation and others should be closely studied during the next few years to obtain all possible information as to growth, survival

and adaptability of each of the trial species. The following species are recommended for planting: (1) Russian Olive, 32 percent; (2) Willow (wildings), 48 percent; (3) Cottonwood, 15 percent and (4) others 5 percent.

Willows should be given a more comprehensive and favorable trial than they have had in other trial planting in the area. Buffalo berry, wild rose, salt cedar and various other native trees and shrubs should also be transplanted in order to determine their value and survival in this type of planting. A suggested arrangement of the species in the plantings would be as follows: two rows of Russian olives, 3 feet spacing nearest the channel; three rows of willows, 1 foot spacing; two rows of cottonwood, 2 feet spacing. Fill the background from the drainageway to the bank with Russian olives, 9 feet by 9 feet spacing. Various other species indigenous to the area should also be tried. A record of the planting scheme should be made after the planting has been completed for future recheck on growth, survival and adaptability of plantings.

Mechanical structures such as tetrahedrons should be tried to protect the plantings until such time as they have become firmly established. Such tetrahedrons can be a simple affair made from posts, poles and barbed wire, and placed near the banks of the stream channel in such a manner that the plantings will be protected during peak flood flows.

The plantations on Carter Draw would be of a spot-planting nature and on the basis of 10,000 trees required per mile, the 4½ miles along Carter Draw, which is proposed for treatment, would require approximately 45,000 trees at an estimated cost of about $2,000.

Other areas, which have been selected for tree planting, are listed as follows:

Little Sand Draw. This area along the main gully would be planted in conjunction with such silt detention reservoirs as are constructed. To assure survival of the plantation, the draw-down tube placed in the dam would permit irrigation of the plantings for a considerably longer period of time than on untreated drainageways. Six miles of the drainageway will be planted with 75,000 trees. The cost of planting on this draw is estimated at $2,500.

Big Sand Draw. About 5½ miles of drainageway, below the proposed dam is suitable for tree plantation. This project would cost about $2,300.

McTurk Draw, a tributary of Beaver Creek, is suitable for planting approximately 55,000 trees on 5½ miles of the main channel and on the lesser tributaries below stockwater reservoirs. A number of such reservoirs have already been installed. The cost of such tree plantings would be about $2,300.

Floodwaters from Devil's Slide Draw, a tributary of Beaver Creek, have caused considerable damage to irrigation facilities on the Yellowstone Ranch. It is believed that planting would aid materially in reducing such annual damages to irrigation facilities on this ranch. Approximately 30,000 trees would be needed on three miles of this drainageway at a total cost of $1,200.

Approximately 23 miles of tree planting is planned along Muskrat Creek and most of such planting should be placed in such areas as will receive the benefit of irrigation water from draw-down tubes. The total trees required on this drainageway is 230,000, the total cost is estimated at $10,000. Since both cattle and sheep range in this area, it may be necessary to fence parts of the area to protect the plantings. Approximately 5 miles of such fence is proposed for installation.

Contour furrows and pitting are proposed for moisture retention and erosion prevention and to increase range feed production on critical areas.

Desilting area fences are proposed for reservoir protection and channel stabilization. Beaver plantings are proposed in several selected areas. Rodent control is proposed for localized areas. Work will continue in brush control and poisonous plant eradication. Stock water development proposals total 144 consisting of 94 reservoirs, 17 wells and 33 springs. Fences are proposed for 115 miles to enable better livestock distribution and to reduce livestock trespass. More operational improvements will no doubt be found necessary when range management adjustments are perfected. The amount of range rehabilitation work which has been completed is insignificant in relation to the magnitude of the needs. With the exception of range reseeding, the developments and facilities which have heretofor been constructed on public domain lands have been mainly of the type which have facilitated livestock operations and livestock movement. The location and types of all improvement proposals are shown on erosion condition and proposed improvement Map No. 2, and a complete listing of proposed improvements with estimated costs and benefits are shown in Table 14.

The solution to the problem of continued watershed impairment, especially as it relates to siltation and sedimentation, is dependent upon two physical accomplishments. First, the soil must be held in place; maintenance of an adequate vegetative cover is the only practicable means by which this can be accomplished over extensive areas. Second, in those areas where establishment or maintenance of an adequate vegetative cover is precluded because of natural conditions such as geologic erosion, the silt must be trapped, if reasonably possible, before it reaches the main channels. Basic sedimentation data as to amounts, origin and movement of silt are inadequate. In order to facilitate a comprehensive program of public land rehabilitation, development and proper utilization, it is believed that additional stations should be installed at or near the mouth of major silt contributing tributaries or at existing stream gauging stations in or near the report area. Such data are needed as a guide to future action. Silt measurement stations have already been proposed by the Bureau of Land Management for the Badwater, Beaver, Alkali, Muskrat and Poison Creeks. The geological Survey has established silt measurement stations at the mouths of Five Mile, Muddy, Cottonwood, Poison, Muskrat and Badwater Creeks and at a number of wastewater drains entering Five Mile Creek in the basin. Early establishment of silt measurement

stations in the major intermittent channels and the installation of coordinated erosion measurement and vegetation plots in selected areas of high silt production within the report area, will go far in providing much needed erosion and sedimentation data. The Bureau of Land Management is cooperating with the U. S. Geological Survey and the Rocky Mountain Forest Range Experimental Station, U. S. Forest Service in making detailed research studies of the erosional processes in the Wind River Basin. Studies on the soil erosion situation were initiated in conjunction with the land classification studies. Within the Bureau of Land Management, this cooperative work is being carried on both as a Missouri Basin function and also under the Branch of the Soil and Moisture Conservation. The location of established program study areas are as follows: In cooperation with tue U. S. Geological Survey one-half mile north of the town of Moneta; in cooperation with the Rocky Mountain Forest Range Experiment Station, U. S. Forest Service in the vicinity of Arminto, Lost Cabin and Beaver Rim. These studies were established in the fall of 1948, and erosion and vegetation measurements are being made twice a year. These studies, when carried on over a period of several years, will furnish basic information for typical problem areas as to rates of erosion and soil loss and adaptability of selected vegetation under varying degrees of use conditions. They will serve as a much needed guide in carrying on future soil conservation measures and practices within the report area.

The summary of range conservation and improvement proposals for public domain lands in the report area, (Table 13) shows an estimated total annual benefit of nearly $150,000. The estimate on probable benefits is based on experience and knowledge gained during the past 15 years of administration protection and development of the public lands under the Taylor Grazing Act. The benefits, which will accrue as a result of these proposed developments, are briefly summarized as follows:

1. Increasing grazing capacities of the forage resources through improved range management, protection, rehabilitation and development.

2. Reduction in resource losses from plant poisoning, predators and rodents.

3. Improved stability of ranch and farm enterprises using both the public land and associated cropland under a properly integrated land use economy.

4. Improved wildlife habitat and hunting by the development of watering places, feeding and nesting grounds and shelter areas on the public domain.

5. Perpetuation of forest and range resources through improved fire presuppression, prevention and control.

6. Sediment retardation through erosion and silt control, and consequent extension of the life of the Boysen Reservoir and other related projects.

7. The stabilization of stream-flow by inducing percolation of precipitation through proper land use and soil and moisture conservation practices. This will also aid in the control of floods.

It is difficult to assign a monetary value to all benefits but conservative estimates indicate that the benefits will greatly exceed the costs over a long-time period. Many of the benefits which will accrue are intangible, which are virtually impossible to evaluate, and include aesthetic, social, recreational, wildlife and downstream values and benefits.

Full benefits to be derived will be conditioned in large measure by the extent to which complementary action is effected by the coordinated efforts of all agencies, organizations, groups and individuals concerned with the full development of the land resource economy in the Wind River Basin.

Table 12.- Summary of principal improvement projects completed by Bureau of Land Management within the report area, Wind River Basin, Wyoming, 1937-48 1/

Type of Project	Unit	Amount
Stockwater Reservoirs	No.	185
Stockwater wells	No.	17
Spring Developments	No.	10
Water Spreading Systems	Acres	500
Reseeding, range	Acres	23,080
Truck trails	Miles	81
Tree planting	Acres	10
Corrals	No.	6
Fences, range	Miles	102
Sagebrush eradication	Acres	2,668

1/ Wyoming Grazing District No. 2 lands only. Compiled from records of Wyoming Grazing District No. 2, Lander, Wyoming, Bureau of Land Management, Region III, Billings, Montana.

Table 13.- Proposed sites and estimated costs of the principal silt control structures and water spreading systems in the report area of the Wind River Basin, Wyoming, 1948 1/

Location			Estimated Size of Dam	Estimated Storage Capacity	Estimated Drainage Area	Water Spreading Benefits	Estimated Cost
Township	Range	Section	(cubic yards)	(acre feet)	(square miles)	(acres)	(dollars)
Muskrat Creek							
33 N.	90 W.	23	30,000	100	11	-	12,000
33 N.	91 W.	28	70,000	300	68	500	28,000
33 N.	92 W.	18	30,000	100	9	-	12,000
34 N.	91 W.	23	5,000	50	5	500	1,000
34 N.	91 W.	26	75,000	450	105	500	30,000
34 N.	92 W.	15	35,000	150	55	600	14,000
34 N.	93 W.	2	30,000	100	50	200	12,000
34 N.	94 W.	11	30,000	100	14	-	12,000
35 N.	93 W.	1	75,000	400	482	-	30,000
35 N.	93 W.	4	58,000	240	274	2,880	23,000
35 N.	93 W.	16	8,000	50	5	-	1,000
35 N.	93 W.	22	30,000	100	225	-	12,000
36 N.	93 W.	6	75,000	400	482	-	30,000
36 N.	94 W.	14	75,000	400	83	100	30,000
Poison Creek							
33 N.	89 W.	6	30,000	100	21	200	12,000
33 N.	89 W.	18	25,000	50	11	100	10,000
35 N.	89 W.	3	30,000	100	18	100	10,000
36 N.	90 W.	19	20,000	70	12	100	8,000
36 N.	90 W.	22	40,000	100	51	200	16,000
37 N.	91 W.	9	45,000	125	6	-	18,000
Badwater Creek							
37 N.	90 W.	1	60,000	400	8	500	24,000
37 N.	90 W.	2	15,000	80	3	320	6,000
37 N.	90 W.	4	30,000	120	5	320	12,000
38 N.	90 W.	11	25,000	100	20	640	10,000
38 N.	90 W.	14	20,000	60	22	-	8,000
38 N.	90 W.	15	20,000	60	25	120	8,000
38 N.	90 W.	32	10,000	100	4	310	4,000
39 N.	90 W.	4	10,000	30	9	-	4,000
39 N.	90 W.	29	20,000	70	19	-	8,000
39 N.	91 W.	33	25,000	100	23	-	10,000
39 N.	92 W.	13	40,000	200	7	-	16,000
39 N.	92 W.	16	15,000	70	2	-	6,000
39 N.	93 W.	25	15,000	70	4	100	6,000
39 N.	93 W.	34	15,000	60	8	60	6,000
39 N.	93 W.	35	40,000	200	4	-	16,000
Beaver Creek							
32 N.	95 W.	9	30,000	2,000	11	-	12,000
32 N.	96 W.	7	10,000	(diversion)	5	-	4,000
32 N.	96 W.	9	15,000	100	13	-	6,000
32 N.	97 W.	3	10,000	60	4	100	4,000
32 N.	97 W.	11	10,000	(diversion)	5	1,000	4,000
32 N.	97 W.	13	15,000	120	4	-	6,000
33 N.	95 W.	27	30,000	1,800	5	400	12,000
33 N.	96 W.	19	10,000	150	20	200	4,000
Little Popo Agie River							
32 N.	98 W.	9	15,000	200	18	-	6,000
32 N.	98 W.	15	10,000	150	5	-	4,000
33 N.	98 W.	28	15,000	200	46	-	6,000
33 N.	98 W.	34	15,000	200	23	-	6,000
Total (47 dams)			1,361,000	10,185	2,084	9,250	525,000

1/ Compiled from field inventory records for the report area, Bureau of Land Management, Region III, Billings, Montana. See Map No. 2, Proposed Improvements, accompanying this report.

Table 14.- Summary of range conservation and improvement proposals for public domain lands in the report area, Wind River Basin, Wyoming, 1948 1/

Type of improvement	Unit	Amount (number)	Life Expectancy (years)	Estimated cost (dollars)	Estimated annual maintenance cost (dollars)	Estimated annual benefit (dollars)
Range Utilization						
Stock water reservoirs	each	135	15	60,700	3,000	13,300
Stock water wells	each	21	20	52,500	1,000	5,500
Spring developments	each	47	20	23,500	500	2,500
Fencing	miles	179	20	125,300	1,000	11,000
Cattle Guards	each	4	20	1,600	50	150
Poisonous plant eradication	acres	2,050	5	4,100	-	1,000
Predatory animal control	each	400	10	4,000	3,000	5,000
Sub-Total				271,700	8,550	38,450
Resource Protection						
Fire prevention pre-suppression & control	acres	300,000	20	1,500	1,500	1,525
Rodent control	acres	30,100	20	7,500	1,000	1,350
Wildlife shelters	acres	200	20	1,000	-	50
Sub-Total				10,000	2,600	2,925
Range Rehabilitation and Silt and Erosion Control						
Silt retention dams, large	each	47	20	525,000	5,000	37,500
Silt retention dams, small	each	460	10	115,000	1,300	25,000
Detention Dams	each	25	10	12,500	100	2,700
Water spreading	acres	12,000	40	60,000	500	7,800
Desilting area exclosures	acres	240	20	9,000	100	1,100
Contour furrows & pitting	acres	11,350	20	34,000	400	4,500
Range reseeding	acres	78,000	40	390,000	-	25,000
Tree planting	tree	500,000	40	25,000	100	2,500
Brush removal	acres	2,180	10	5,400	-	800
Beaver plantings	each	50	20	1,600	-	150
Sub-Total				1,177,500	7,500	107,100
TOTAL				1,459,200	18,650	148,475

1/ Compiled from field inventory records for the report area, Bureau of Land Management, Region III, Billings, Montana. See Map No. 2, Proposed Improvements, accompanying this report.

Problem 2. Land-Use Maladjustments

Land-use and operations should be adjusted so as to improve range conditions. Increased forage production and the prevention of soil and water losses will require continued vigilance and earnest effort on the part of operators and administrators. This correlated land-use management should be designed not only to promote a maximum forage production but should seek to restore and maintain optimum watershed conditions from the standpoint of water yield, flood control, silt and sedimentation control and human needs. The utilization of the vegetative cover with its widely varying forage production by grazing livestock to secure the maximum meat and wool production compatible with range improvement calls for an ever-changing and dynamic program, challenging the best ability of the livestock operators and range managers. The use of range and farm lands should be so coordinated that both classes of land will benefit. This coordination would also be advantageous to the operators of both types of land, and would aid the livestock industry. The production of additional feeds under irrigation to augment the range supply, especially in winter and during the critical spring growing period, will benefit range conditions by providing feed so that the use of the range can be reduced. Supplemental feeding will also reduce livestock losses from storms and will thus help to stabilize the industry and increase the profits of the operators.

Crop land and the irrigated pasture lands should provide at least an average 25 percent of the available feed supply for each operator instead of the present 12 percent average which now exists in the report area. Range use of each public domain operator should be so integrated with crop land, hay lands and irrigated pasture that the requisite portion of the base property will supply at least 25 percent of the total annual feed requirement. This provision with storage of hay for emergency periods, would provide for protection of the range, guarding both its productive capacity and lowering the erosion potential of the land itself. A re-appraisal of base property requirements should be made in relation to the future development of irrigated lands in order to coordinate irrigation development with public range utilization. Such re-appraisal of base properties would apply to that portion of the report area within the Wind River Grazing District.

The proposed Boysen Reservoir will displace the operations of seven Federal range permittees. Part or all of their base properties and a small area of Federal range will be inundated. The total area of base properties affected is 6,304 acres, with 4,194 animal unit months of grazing capacity. Adjustments in operation have been made so that operators losing lands by the development of the Boysen Reservoir have transferred their grazing privileges to other base properties which are capable of complementing their grazing privileges on public domain lands. A total of 8,298 acres of former public domain with a grazing capacity of 1,230 animal unit months has been withdrawn for reclamation purposes, for the Boysen development. Grazing management of reclamation withdrawal areas will continue to be administered by the Bureau of Land Management until the land is placed in a more productive use.

Areas adjacent to the shores of Boysen Reservoir, which are to be used for recreation or shore protection, will in a number of instances require fencing. Water gaps for access of livestock to water are desirable in Sections 6 and 20, Township 39 North, Range 94 West, and in Section 7, Township 38 North, Range 94 West. The planting of shrubs and trees is planned jointly by the Fish and Wildlife Service, the Bureau of Indian Affairs, the National Park Service and the Bureau of Land Management, on 1,300 acres along the shore-line of the lake. The plan calls for the irrigation of the plantings until they have become firmly established. Indian lands make up 1,200 acres of the proposed planting area, and reclamation withdrawals presently administered by the Bureau of Land Management, compriso 100 acres of the area. Increased demands for recreational purposes will undoubtedly necessitate the integration of such multiple uses. Thus, grazing use may have to give way to such higher uses as recreation. It will be necessary to provide access roads through various recreational areas proposed along the lake shore.

The complex scattered or checker-boarded pattern of land ownership on parts of the area presents a difficult problem. There are small isolated tracts of public domain which are surrounded by private lands and conversely, similar tracts of private land which are isolated in areas of concentrated public domain. Most of these isolated tracts in both types of ownership are chiefly valuable for grazing. For example, there are 27 isolated tracts of public domain in the 3 townships described as Township 36, Ranges 87, 88 and 89 West, 6th Principal Meridian. The tracts range in size from 40 to 960 acres. Nine of these are 40-acre tracts, four are 80 acres in size, two are 120 acres, four are 160-acre parcels, and eight which vary in size from 320 acres to 960 acres. In Township 32 North, Range 99 West, and Township 33 North, Ranges 99 and 100 West, there are 25 isolated tracts of public domain ranging from 40 to 1,160 acres in size. Eleven of these tracts are only 40 acres in extent. The advantage of the provision for sale of isolated tracts of public domain lands through Section 14 of the Taylor Grazing Act should be publicized for such areas where it would not be in the public interest to retain control of isolated public domain tracts.

Isolated tracts of private lands in areas where public domain dominates are often even more scattered, although very often they are used for ranching or farming purposes. A number of parcels of private and state lands are found interspersed with public domain which lack adequate tenure and control by resident ranch operators. Most of the private lands in this category are located in Natrona County and are controlled by absentee owners who are not in the range livestock business for which the lands are usually best suited. Often the lands are held for purely speculative purposes and are unavailable for lease to the adjoining resident ranch operator. Seldom enclosed by fence, these lands are often an obstacle in the way of conservation management since their lapse into an uncontrolled status are almost certain to cause them to be overgrazed through trespass use. Not only is a potential income from a managed resource lost to the absentee owner, but such unstable and inadequate tenure contributes towards instability of the basin's resources and economy. Adequate methods and devices to put such lands under control seem desirable. Some of these lands lend

themselves to public ownership and management. There are many opportunities for exchanges of range lands to effect consolidations in both public and private classes of ownership. Such consolidations would promote more efficient and effective administration. Private and state lands in the area could be leased by the Federal Government for administrative purposes under the Pierce Act. Proposals for the adjustments in land ownership are shown on Map No. 5, Land-use suitability and proposed ownership adjustment map.

As depicted on Map No. 5, there are a number of isolated tracts of stock driveway lands which serve no useful public purpose. Withdrawal of these lands should be lifted and the lands should then be placed in grazing use under permit or lease. In some cases, the land may be more suitably located for exchange or sale. Stock driveway withdrawals in some areas have not been used for driveway purposes for a considerable period of time. They are more or less isolated from the more important driveways and it is recommended that such lands be leased to adjoining land owners for grazing purposes. One portion of stock driveway in Sections 13 and 14, Township 32 North, Range 100 West lies adjacent to three small tracts of public land, each parcel of which is leased to a different individual for grazing purposes and not connected with any other large blocks of public domain lands. Such land holdings or leasing of various operators should be consolidated in the public interest.

In a number of instances, advantage should be taken of natural barriers to livestock movement in the allotment of grazing privileges and also in the leasing of land under Section 15 of the Taylor Grazing Act. Allocating the land by legal subdivisions often creates a maladjustment in land use. Better distribution of livestock and better utilization of the forage can often be obtained by adjustments in allotment boundaries. The use of natural barriers will obviate the need for fence and will thus reduce an otherwise expensive range development.

The chief values of the timber cover found on the public domain lands are for watershed and wildlife conservation. Reflecting the semi-arid conditions under which the forests have developed, they seldom form a complete cover, and rainfall is insufficient for the development of commercial timber. The only potential commercial timber land on the public domain comprise relatively small acreages of lodgepole stands on tracts adjoining similar lands on the Shoshone National Forest near Lander and Dubois. Most of these timbered areas are not readily accessible for logging operations and, in themselves, seldom constitute an economic cutting operation. Livestock make little use of the area because of its rough, rocky or mountainous nature and moreover the forage produced is scanty. While selective harvesting of the timber resources may become feasible at some future date, the chief values at the present time are for watershed and big game habitat purposes. As such, these timbered areas should be so managed that the wildlife and watershed values are fully protected and perpetuated. The timbered areas of the public domain, which lie adjacent to the National Forest lands and which are principally of value for timber, watershed or wildlife, can in many instances, best

be administered in connection with land-use and management and protection programs of the National Forests. As shown on Map No. 5, such areas are located on the margins of the Dubois area, in Township 33 North, Range 101 West and along the extreme western margin in the Popo Agie drainage west of Lander. Demand for "free-use" timber by local residents in the vicinity of Lander has totalled less than 10,000 fence posts and 3,000 corral poles during the past 10 years. Most of such harvested forest products were obtained from public domain in Township 31 North, Ranges 98 and 99 West and Township 32 North, Ranges 98, 99 and 100 west, 6th Principal Meridian. Permits were issued to 30 "free-use" applicants. The present practice of selective cutting insures a sustained yield and the maintenance of an adequate forest cover. In view of the possible increase in demand for "free-use" timber and to curb promiscuous tree cutting, it appears to be in the public interest to designate and post certain areas to be reserved for community purposes. Besides the Lander area, the demand for "free-use" timber in the Shoshoni-Lysite area appears to justify the designation of the Copper Mountains as another "free-use" timber cutting area. Township 39 North, Ranges 88 and 92 west and Township 40 North, Ranges 88, 92 and 94 West, 6th Principal Meridian, comprises the timbered area in question. A few permits have also been issued in the Dubois area, Township North, Range 107 West and Township 42 North, Range 108 West. Further studies should be made to determine the need for designating "free-use" cutting areas in the Dubois area.

The timbered public domain, while scattered and comparatively small in extent, has a disproportionately large influence in watershed values. The forest cover occupies steep slopes and highly erosible soils, which are subject to occasional torrential storms and rapid snow-melt. Even though the canopy is far from complete, the forest cover has a high protective value. Forest management and use should be regulated to assure that optimum watershed conditions are perpetuated.

The isolation of the Dubois area (see Figure No. 1 opposite page III) and the generally scattered, checker-boarded nature of the public domain lands there present a problem in administration. About 25 percent of the Dubois segment is public domain land, or 41,113 acres in a gross area of 160,741 acres. There are 21,483 acres or 13 percent of state lands, and 98,145 acres or 61 percent of private lands in the area. The Dubois area is surrounded on three sides by the Washakie National Forest, and joins the Wind River Indian Reservation on the east. The largest block of public domain land is 10,900 acres. Most of the public domain and state lands are leased for grazing. Consideration of the natural resources of the Dubois region, their utilization, and the problems involved, some of which have been presented, suggests several possibilities for the future administration of this area. Among these possibilities are the following proposed for consideration:

1. For the state to acquire such public lands to round out their wildlife requirements. Under this proposal, the state may find it advisable to administer portions of the area because the best major use thereof might well become a big game range and recreational area. Under this proposal, public domain lands in

the Dubois area could be exchanged for state lands elsewhere and thus tend to consolidate both classes of lands.

2. For administration by the Forest Service of such lands which are primarily important for purposes of watershed and timber management. A number of public domain tracts lie immediately adjacent to or near the National Forest boundaries which surround the report area on three sides. Under this proposal, exchanges would be made with the Forest Service for grazing land elsewhere.

3. For administration to continue under the Bureau of Land Management, consolidating public domain holdings as much as feasible by exchange. Public domain lands adjoining the National Forest could be transferred to the Forest Service for administration. State lands in the area could be exchanged for public domain lands in eastern Wyoming, for example. For the remaining lands, those which are not needed for public purposes, disposition could be made through public sale or exchange.

Proper land-use can and should be improved for public domain lands which lie outside of the Wind River Grazing District within the report area. The present staff of the Wind River Grazing District is not sufficient to properly administer the public lands outside of the grazing district in addition to their essential duties within the district. Additional administrative personnel are needed to enforce regulations and obtain compliance concerning the proper use of the public domain.

A problem indirectly related to the problem of land tenure and public land control is that of the need for cadastral resurveys for public domain areas where precise horizontal control is inadequate or entirely lacking. Field studies revealed the need for re-establishment and monumentation of public survey corners in all or parts of fifty townships within the report area. Not only will such cadastral resurveys prove beneficial for the proper administration of the public lands and development programs thereon, but will expedite location surveys made by other public land users, such as ranchers, oil and gas exploration and development firms, county surveyors, highway engineers and others. In addition to the fifty townships requiring resurveys within the report area, it may be of interest in passing to note that approximately 28 townships within the Wind River Basin have never been covered by cadastral surveys. The unsurveyed area lies within the Shoshoni National Forest. Twelve townships are authorized for resurvey in connection with Bureau of Reclamation development programs. The ninety townships requiring cadastral survey or resurvey within the Wind River Basin will entail an estimated expenditure of $575,000.

Problem 3. Administrative Problems

Prior to the passage of the Taylor Grazing Act in 1934, the public domain range lands in the report area, as elsewhere, were seriously overgrazed and overstocked. Since the passage of this Act, the use of public domain lands have been under regulation. Optimum conditions on the public range lands has not yet been reached despite this program of conservation management coupled with the favorable growing years from 1937 to 1947. The need for improved management practices and additional range improvements has not yet been fully met. There is evidence of improvement in range conditions on parts of the report area during the recent years of management and favorable period of growing conditions. For example, in the Twin Creek watershed many of the once raw gullies have healed with grass and brush. This improvement has been due largely to actual stocking of the range below the estimated carrying capacity. There is, on the other hand, ample evidence in other parts of the area to indicate that excessive rates of stocking or improper seasonal use are resulting in continued deterioration of the range and soil resources.

Periodic variations in the production of forage occasioned by wide variations in the amount and effectiveness of the precipitation make it imperative that grazing capacity of the range be based upon the amount of forage produced in a below-average year. Use of the forage resources on this basis is essential if improvement of the range is to be obtained and is necessary for a sound livestock industry. Stocking on the basis of below-average forage production will assure the maintenance of sufficient plant cover so that the amount of accelerated erosion can be reduced. Continued over-utilization of the public domain resources will tend to decrease forage production in both quantity and quality. Improvement of the vegetative cover will reduce soil and water losses and permit the reduction of the silt load entering drainages leading to the reservoirs.

The inventory of the forage resources in the area made in 1947 showed that 14 percent of the public domain area was in poor condition, 64 percent in fair condition and only 22 percent in good condition and none in excellent condition. This condition of the range, after a long series of favorable years, emphasizes the need for drastic action if the range is to be restored to its maximum productivity and if silt production is to be reduced. Condition classes on the area are distributed among the land use capability classes as shown in Table 8 and portrayed on the land use capability Map No. 3. Future stocking should be based upon the grazing capacity of the public domain lands as determined by the vegetative type and site considerations. Proper stocking and seasonal use are the administrative problem of the range manager and the permittees concerned. Within the Wind River Grazing District, the correct seasons of use and rates of stocking have been determined and the analysis of the field data indicates that the optimum use and numbers are being approached. Outside of the grazing district, more remains to be done in respect to the use of the public domain lands. The need for management plans and coordinated improvement development is particularly important on areas outside of the grazing district where concentrations of public domain land exist. For the most part, what improvements have been constructed in these areas have been placed on

adjacent patented or state owned lands by private operators and are very often temporary in character. Fences to control livestock movement and water developments to assure proper distribution of livestock are the principal types of range improvement which have been placed on such lands. The need for additional improvements is especially acute on the public domain lands.

Operations on lands outside of grazing districts are generally on an individual ranch unit basis. In recent years, the trend has been steadily downward in the utilization of the range area by sheep, with a proportional increase in range use by cattle. Within the grazing district, the dual range use by both sheep and cattle is becoming an ever-increasing problem. The trend toward increased numbers of cattle has increased the dual use problem because the cattle trespass upon the sheep units and are free to graze within broad limits, while sheep are herded. The development of individual fenced range units is perhaps the solution to this problem of dual and off-season use.

The number of stock permitted on Federal range in the Wind River Grazing District, part of the report area, is 183,385 animal unit months. This represents 15 percent in excess of the estimated grazing capacity of 159,465 animal unit months available. Fortunately, however, the actual annual rate of stocking for the past several years, has been estimated to be 15 percent below the grazing capacity or an average of 135,431 animal unit months. This rate of stocking below the grazing capacity of the range has been largely due to the scarcity and high cost of ranch labor during recent years. This has been especially true of sheep operations. Cattle ranching has been a more attractive enterprise than sheep in recent years, and a number of range operators have changed from sheep to cattle. In making the change, the numbers of animal units are usually temporarily reduced. Because of the labor and market situation, a number of the permittees are temporarily out of the livestock grazing within the district. Some non-use permits have been issued and some use by other permittees has been extended to these non-use areas when conditions have been favorable for such use. Permittees within the grazing district have the right to run livestock to their maximum permitted numbers. If all permittees were to do so, the Federal range would be stocked to a point 15 percent above the grazing capacity. The existence of this problem of excess allowance of 23,920 animal unit months on the basis of maximum permitted numbers is a precarious situation immediately confronting the public lands administrator. Therefore, an analysis should be made of all permits to determine how this reduction in permitted numbers may best be accomplished. It is not to be implied that this situation exists on all parts of the report area, but rather that it exists in areas where operations are primarily of a dual nature and located on such areas where several operators are permitted to run on the same Federal range. While up to the present time this situation may not have contributed toward the deterioration of the Federal lands, it nevertheless poses a potential problem which will remain unsolved until permitted livestock numbers have been reconciled with the grazing capacity of the Federal range.

The situation described in the above paragraph can be somewhat alleviated by the development of additional irrigated farm lands for the production of supplementary feed, especially hay and the irrigated pastures. Such developments would be of utmost value to the livestock industry and would beneficially affect the public range lands of the area, as they could provide additional feed base which can be used to properly feed livestock for such periods of time when the range does not supply sufficient forage. The elastic cushion thus provided by this buffer of feed produced on irrigated lands will not only serve to protect the range against over-use during periods of low range forage production, but will also permit the maintenance of livestock gains during such critical periods. The development of additional irrigated lands and the production of supplementary feeds upon these lands will both directly and indirectly benefit the public domain range lands by reducing the period of use on such lands and thereby promote their rehabilitation. The production of additional supplementary feeds should, therefore, be encouraged. The development of additional irrigated lands is largely dependent upon the construction of storage reservoirs which would conserve the volume of peak flows for use during the irrigation season. At the present time, the normal flow of streams supplying irrigation water to the area are usually not sufficient during the irrigating season to provide water for all the land which could be irrigated. It is recognized that a more conservative use of the present supply of irrigation water from the point of its diversion to the point of its return to a stream as waste water would result in a considerable increase in irrigable areas and a marked reduction in erosion, siltation and sedimentation. Only insofar as such practices reduce the amount of supplementary feeds produced, does this problem relate to the public domain range lands. The proper use of irrigation water will also go a long way toward increasing the supplies of supplementary feeds and overcome the drainage difficulties which have been experienced on some of the irrigated lands in the report area.

The construction of four dams is planned by the Bureau of Reclamation to store peak flows as a means of providing additional irrigation water for the development of new farm lands in the report area. The construction of one, the multi-purpose Boysen Dam, is now underway. The proposed Shoshoni Irrigation Unit of 16,600 acres will be irrigated by pumping from Boysen Reservoir. About 3,000 acres of this unit are located within the report area and will directly affect the use of public domain lands lying adjacent to the unit. The Badwater Dam is planned to store 7,500 acre feet of water to irrigate 1,100 acres of new development and to provide supplementary water for 2,700 acres of the Badwater Unit in the area. Here again, adjacent public domain lands will be affected. Within these areas, a reduction in the period of use of the public domain lands will be the greatest beneficial effect of the development of additional irrigated lands. Early spring and late fall livestock use on potential irrigated pastures and the feeding of additional supplementary feed during the winter will alleviate public land use during those critical periods. Onion Flat Dam near Lander is planned to store 13,500 acre feet of water to irrigate the Hudson Bench Unit of 5,700 acres adjoining the report area. DuNoir Reservoir in the Dubois area is planned with a capacity of 260,000 acre feet to irrigate 100,000 acres of new land on the Wind River Indian Reservation. The latter two reservoirs will have little direct effect upon the use of the public domain lands since most of the beneficiaries of such developments do not operate on public domain range lands. While the greater

portion of the lands to be irrigated are privately owned, the irrigation of such lands should provide a more dependable winter and spring feed supply for public domain range uses. If livestock are kept off of the range lands during early spring, the livestock losses from unseasonal storms would be largely prevented.

It is recognized that with the development by irrigation of additional private lands not now controlled by public land users, there may be an increase in the demand for grazing on public lands. However, since the present demand utilizes the available forage, this additional demand could only be met by an adjustment in the seasonal use on public grazing lands.

Dry farming within the report area has proven unsuccessful because of limitations imposed by climate, soil and topography. Establishment or expansion of this type of agricultural use of the public land is not recommended.

Not until the Taylor Grazing Act was passed in 1934 was effective control exercised on the grazing use of the public domain. To assist with the administration and to give local participation in the management of grazing districts, the Act was amended in 1939 to provide for district advisory boards as a permanent feature of grazing district administration. Section 18 of the Act provides for the establishment of advisory boards to cooperate in the administration of grazing districts. Such an advisory board, elected by qualified Federal range permittees or licensees, is constituted in the Wind River Grazing District. The functions and duties of the board are to advise and make recommendations on such matters as proper rules of fair range practices, allotments of range for community or individual use, seasonal use, applications for the construction or maintenance of improvements on the Federal range, and wildlife matters. The work of the board constitutes a splendid example of on-the-ground working relationships with the public land administrator of the Wind River Grazing District. The comprehensive development of the resources in the basin will operate to shape and influence new patterns and demands in multiple public land uses. The advice and counsel of the advisory board will aid the public land administrator in making equitable adjustments to meet trends and conditions brought about by the complexities of increased population and full development of the basin.

There are 129,478 acres of public lands reserved for stock driveway purposes in the eastern portion of the area, located within and outside of the Wind River Grazing District, as shown on the maps accompanying this report. The stock driveways lying outside of the Wind River Grazing District have been entirely unregulated until July, 1948. These stock-driveways are heavily used and as a result of this unregulated use, they are in a deplorable state, having all the characteristics of range land experiencing misuse by livestock. The stockmen as well as the officials of the Bureau of Land Management recognize the need for immediate action in putting these stock driveways under proper use. In recognition of this problem a range rider has recently been employed to regulate use upon these driveways. The stock driveway known as EK Trail, located

on the Powder River-Badwater divide on the extreme eastern portion of the report area, has been particularly vulnerable to trespass use in addition to the legitimate trailing use. Alleviation of this excessive use can be partially accomplished by the construction of fences and by range rider patrol.

Livestock trespass has been a constant problem on the report area. Horses loose on the range have been the most frequent source of trouble. Failure of some permittees and liconsees to duly regard seasonal dates is also an additional source of trouble. Some cattle or sheep operators have frequently used portions of the area without license or permit. Cattle are relatively free to graze over large areas because of the lack of sufficient barriers or fences. This leads to trespass on sheep units by cattle, especially out-of-season trespass on winter sheep units. The fact that cattle numbers are increasing while sheep numbers are decreasing is causing this problem to become more acute. The construction of fences is perhaps the principal solution to prevent dual trespass use. Where feasible, natural barriers combined with fences should be utilized to separate seasonal ranges, to control trespass and to prevent undesirable dual use. The establishment of individual allotments which are enclosed by natural barriers and fences will assist in proper range management and utilization. Individual range allotment areas are recommended as they can be more readily checked for proper use of the range lands and conservation control can usually be more readily achieved with better results for both the operator and the range. The fact that several sheep and cattle operators are permitted use in the same allotment or one operator in several allotments, have often contributed to the problem of improper range use of the public lands. This problem is especially true in a number of winter range allotments within the Wind River Grazing District.

Some public domain lands lie adjacent to intensively irrigated developments where pressure from farm livestock intensifies use and leads to trespass dual use and out-of-season use. Quite often such public lands are steep-sloped, rising out of the valley floor, and excessive use on such areas is especially detrimental. This condition, while local in nature, may increase with the development of additional irrigation facilities. Regulation of use on such areas is essential to range improvement and to the reduction of silt movement and soil losses.

Poisonous plants have caused serious livestock losses in the Copper Mountains east of the Boysen Reservoir. It is proposed to treat, with herbicides, 2,600 acres infested with larkspur to control this noxious plant. This proposal is shown on the proposed improvement Map No. 2. Some sheep have been lost in the spring from death camas, a plant which is prevalent on much of the area, but the problem, except in small localized areas, is not serious. Deferral of grazing until palatable range plants have made a substantial spring growth will usually eliminate livestock losses from this noxious weed. Selenium is present in the soil in an area near Lysite, causing livestock losses from "alkali disease", or selenium poisoning. Saltbush is the carrier of this element. Proper stocking combined with avoidance of use of the danger area insofar as possible, will virtually eliminate losses from this source.

The recurrent problem of rodent and insect infestations are important contributing factors to forage depletion and result in vegetation and soil deterioration. Effects are generally quite localized, although damage by grasshoppers was particularly severe during the 1948 season. Measures to control these infestations over broad areas are becoming increasingly important.

Losses of livestock by predators is also a recurrent problem, but one which is not especially serious in the report area. Reports indicate that sheep losses from predation have ranged from 1 to 2 percent, with little loss to cattle and horses.

Few fires have occurred in the report area. Nevertheless the problem of fire control will become increasingly important as public land rehabilitation progresses and more intensive protection becomes necessary. The fire hazard is greatest in the timber covered lands adjacent to the National Forests in the Lander and Dubois areas. Because the principal hazard areas are located adjacent to relatively high concentrations of population, these same areas are relatively high risk areas as well. The report area is protected by the fire control and organization plan of the Wind River Grazing District. Fire caches have been installed at strategic points and contracts signed with per diem fire guards usually cooperating with local ranchers. The organizational fire plan calls for additional fire caches to be established at other strategic points in the Dubois area and in the Badwater and Beaver Rim areas.

The concept of multiple land use will become increasingly important as action is taken on the construction of improvements on the public domain lands. Recognition of possible increase in public demand for certain future uses must be borne in mind. Marked benefits to migratory birds, principally ducks, will occur as the action program progresses on the construction of stock water reservoirs, large silt detention and diversion dams. The fenced desilting areas above such reservoirs and detention dams will provide ideal habitats for upland game birds. The construction of large and small reservoirs, the improvement of range land by range reseeding and water spreading and the development of stream bank plantings, will benefit not only migratory waterfowl and upland game birds, but will benefit deer, elk, antelope and aquatic fur brearers.

With the development of the land and water resources of the area, an increase in the population will no doubt result. Concurrently, the demand for recreation areas, cabin sites, business sites, wildlife areas and other special uses will increase. The use values of each must be considered and a determination made as to the highest uses to which the public lands can be put in the public interest. The public interest must not be sacrificed for expediency and compromise in effectuating the plan and applying it to the public domain. The application and integration of these multiple uses will pose a number of problems to the administrator. The public lands now contribute to recreational uses, including fishing, hunting, camping and picnicking.

With increased development of the report area will come an increased demand for additional recreational uses. Fishermen, hunters and picnickers make considerable use of the area west of Lander and in the Dubois area at the present time. Camp grounds should be developed at several places along Twin Creek and Beaver Creek where the demand for such facilities has already proven considerable. Such installations will have a secondary benefit in that there will be a reduction in fire risk through the elimination of promiscuous camp fires. Such increased recreational use will increase the problems of sanitation. The construction of large impounding reservoirs will exert considerable influence on recreational uses of the adjoining public lands. Plans for such recreational development adjoining these reservoirs is the function of the National Park Service and the integration of the needed public domain lands with their recreational plans is a joint undertaking of both agencies.

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A P P E N D I X

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Table 15.- Mean annual and monthly precipitation at Wind River Basin Stations, Wyoming, 1947 1/

Station	Elevation (feet)	Length of Record (years)	January (inches)	February (inches)	March (inches)	April (inches)	May (inches)	June (inches)	July (inches)	August (inches)	September (inches)	October (inches)	November (inches)	December (inches)	Annual (inches)	Range in annual Precipitation (inches)	
Duoois	6,917	40	.47	.44	.54	1.09	1.40	1.21	.86	.83	.96	.99	.39	.35	9.33	5.47	15.88
Middle Fork	6,275	29	.66	.98	1.54	3.36	3.18	1.31	1.24	.92	1.66	1.99	1.03	.68	18.49	10.46	35.01
Fort Washakie	5,583	41	.38	.36	1.06	1.88	2.07	1.02	.73	.66	.72	1.00	.53	.36	10.77	5.22	25.24
Diversion Dam	5,574	28	.25	.26	.45	1.37	1.72	1.09	1.08	.76	.91	1.11	.38	.21	9.59	5.05	16.28
Lander	5,564	55	.56	.63	1.19	2.06	2.26	1.15	.69	.53	.92	1.36	.60	.68	12.63	7.25	21.56
Pavillion	5,440	29	.24	.19	.46	1.19	1.72	1.22	.97	.74	.98	1.05	.38	.20	9.34	5.20	20.75
Riverton	4,954	32	.17	.25	.49	1.38	1.93	1.17	.97	.64	.97	1.17	.46	.21	9.81	6.05	18.43
Shoshoni 2/	4,833	9	.20	.22	.54	1.14	1.19	1.10	.65	.60	.64	.92	.22	.20	7.62	4.73	12.96
Mean	5,643	33	.37	.42	.78	1.68	1.93	1.16	.90	.71	.97	1.20	.50	.36	10.95		
Median 3/	5,569	30	.32	.31	.54	1.38	1.83	1.16	.92	.70	.94	1.08	.43	.28	9.70		

1/ Compiled from Climatological Data, Wyoming Section, Year 1947, U. S. Department of Commerce, Weather Bureau, Cheyenne, Wyoming, except for Shoshoni Station.

2/ For nine years, 1931, 1934-39, 1940-41.

3/ Statistically and actually the median in this case not only represents a more accurate figure for the data of the stations, but also for the greater portion of the area which is the farming and range land on the floor of the valley. The smaller portions of the range lands in the foothills and the summer range in the mountains has a greater precipitation, as represented by the Middle Fork Station, and probably ranging up to 60 inches or more in the snow pack and glacial areas at high elevations, which are such heavy contributors to the valuable summer stream flow.

Table 16.- Monthly and annual average temperatures, Wind River Basin Stations, Wyoming, 1947 (degrees Fahrenheit) 1/

Station	Length of Record (years)	January	February	March	April	May	June	July	August	September	October	November	December	Average Annual
Dubois	40	21.6	23.4	29.2	38.1	46.0	54.1	60.4	58.7	50.8	42.2	31.6	23.7	40.0
Middle Fork	29	23.0	25.6	31.6	40.7	50.3	59.4	68.3	65.9	56.2	45.7	33.6	25.2	43.8
Fort Washakie	41	21.4	24.3	32.3	43.3	52.4	59.5	66.6	65.9	56.2	45.4	32.4	26.9	43.9
Diversion Dam	28	19.6	24.0	32.7	42.5	52.5	60.8	68.9	66.4	56.3	45.7	31.1	22.3	43.6
Lander	55	18.3	22.5	32.4	42.4	51.2	60.5	67.4	65.5	55.7	43.5	30.3	20.4	42.5
Pavillion	29	17.7	24.5	33.8	44.1	54.6	63.4	71.7	68.8	58.5	46.0	30.6	20.4	44.5
Riverton	32	14.4	22.2	33.1	44.0	53.8	62.5	70.0	67.1	57.1	44.8	28.1	16.6	42.8
Shoshoni 2/	6	18.0	22.9	36.7	45.4	58.0	67.6	75.2	71.8	60.1	47.9	28.6	19.4	46.0
Average	32	19.2	23.7	32.7	42.6	52.3	61.0	68.6	66.3	56.4	45.1	30.8	21.9	43.4
Average 7 stations of long record, 1-7	36	19.4	23.8	32.2	42.2	51.5	60.0	67.6	65.5	55.8	44.8	31.1	22.2	43.0
Average 3 Riverton Project stations, 1,6 & 7	30	17.2	23.6	33.2	43.5	53.6	62.2	70.2	67.4	57.3	45.5	29.9	19.8	43.6

1/ Compiled from Climatological Data, U. S. Department of Commerce, Weather Bureau, Wyoming Section, 1947.

2/ Compiled from Climatological Data, U. S. Department of Commerce, Weather Bureau, Wyoming Section, 1934-36, 1938 and 1940-41.

Table 17.- Growing season, Wind River Basin Stations, Wyoming 1947 1/

Station	Elevation	Length of Record (years)	Length of Growing Season: Average (days)	Length of Growing Season: Range From (days)	Length of Growing Season: Range To (days)	Date of last frost in Spring: Average (date)	Date of last frost in Spring: Range From (date)	Date of last frost in Spring: Range To (date)	Date of first frost in fall: Average (date)	Date of first frost in fall: Range From (date)	Date of first frost in fall: Range To (date)
Dubois	6,917	39	86	53	129	June 10	May 20	July 2	Sept. 5	July 19	Oct.10
Middle Fork	6,275	28	133	125	184	May 17	Apr. 7	May 29	Sept.28	Sept. 7	Nov. 1
Fort Washakie 2/	5,583	11	113	74	147	May 29	May 1	June 28	Sept.16	Sept. 8	Sept.28
Diversion Dam	5,574	27	131	96	177	May 14	Apr.10	May 29	Sept.22	Sept. 6	Oct.16
Landers	5,564	49	131	70	193	May 15	Apr.12	June 20	Sept.23	Aug. 23	Oct.28
Pavillion	5,440	28	144	124	175	May 8	Apr. 9	June 1	Sept.30	Sept.15	Oct.30
Riverton	4,954	32	131	75	162	May 16	Apr.26	June 16	Sept.23	Aug. 7	Oct.19
Shoshoni 3/	4,833	8	149	128	177	May 6	Apr.18	May 20	Oct. 6	Sept.21	Oct.20
Average	5,643	28	127	96	168	May 18	Apr.20	June 10	Sept.23	Aug. 29	Oct.19
Average of Riverton Project Stations (Riverton, Pavillion, Diversion Dam, with comparable records)	5,323	29	135	103	171	May 13	Apr.15	June 5	Sept.25	Aug. 30	Oct.22

1/ Compiled from records of the Weather Bureau and "Climate and Man", U. S. Department of Agriculture Yearbook, 1941. Weather Bureau records include Climatic Summary of the United States, 1930, Section 13, northeastern Wyoming, and the year reports, Climatological Data, U. S. Department of Commerce, Weather Bureau, Wyoming Section for the years 1899-1947.

2/ Years of record, 1900-06 and 1944-47.

3/ Years of record, 1931, 1934-36 and 1938-41.

Table 18.- Monthly and annual average heat units, Wind River Basin Stations, Wyoming, 1947 1/

Station	Length of Record (years)	April (units)	May (units)	June (units)	July (units)	August (units)	September (units)	October (units)	Total Annual (units)
Dubois	40	—	93	333	539	487	234	—	1686
Middle Fork	29	—	226	492	784	710	396	84	2692
Fort Washakie	41	9	291	495	732	710	396	74	2707
Diversion Dam	28	—	294	534	803	725	399	84	2840
Lander	55	—	254	525	756	697	381	15	2630
Pavillion	29	33	360	612	900	800	465	93	3262
Riverton	32	30	335	585	837	747	423	56	3013
Shoshoni 2/	6	72	465	738	998	893	513	152	3831
Average	33	18	267	539	794	721	401	70	2833
Average 7 stations of long record, 1-7	36	10	265	511	764	697	385	58	2690
Average 3 Riverton Project Stations, 1,6 & 7	30	21	330	577	847	757	429	78	3038

1/ Compiled from the data given in Table 16 by deducting 43°F. from the average monthly temperatures and multiplying the subtrahends by the number of days in the month, after the method of Johnson and Saunderson, "Types of Farming in Montana", Bulletin No. 328, Montana State College Agricultural Experiment Station, Bozeman, Montana. 43°F. is recognized as the critical temperature above which plant growth takes place in most range and cultivated plants.

2/ The data for Shoshoni are for six years, 1934-36, 1938 and 1940-41. While it is not strictly comparable, it may be regarded as relative.

Table 19.- Length and watershed areas of the principal streams relating to the report area in the Wind River Basin, Wyoming 1/

Stream and Location	Distance above Boysen Dam (miles)	Drainage Area (sq.miles)	Tributary Streams: Length of Stream (miles)	Tributary Streams: Drainage Area (sq.miles)
Wind River at Boysen Dam	0	2/ 7,741	-	-
Muddy Creek	13	6,957	70	3/ 400
Badwater Creek	14	6,110	65	4/ 846
Poison Creek	17	5,583	50	4/ 521
Muskrat Creek	27	4,439	61	4/ 762
Junction of Wind and Popo Agie Rivers	44	4,237	-	-
Popo Agie River	44	1,979	62	-
Little Wind River	59	5/ 816	42	3/ 719
Little Popo Agie	66	5/ 431	41	5/ 354
Middle Fork	74	-	-	5/ 89
Wind River	44	2,230	125	-
near Burris, Wyoming	109	5/ 1,080	-	-
Red Creek	115	5/ 1,046	10	5/ 22
Horse Creek	129	5/ 345	28	5/ 135
Warm Spring Creek	134	5/ 223	22	5/ 90

1/ Adapted from publication, "Missouri River Basin River Mileage and Drainage Areas", Corps of Engineers, Missouri River Division, Omaha, Nebraska, February 1948. Hydrologists and cartographers consider the Big Horn River as extending to the confluence of the Wind and Popo Agie Rivers. Historians and local nomenclature consider the names as changing at the north end of Wind River Canyon, Wind River running northward through the canyon. The total drainage area of the Big Horn River is 22,942 sq. miles, one-third of which is tributary to the Boysen Dam. The site of the Boysen Dam is located 292 miles above its mouth.
2/ Drainage area compiled by the Bureau of Land Management for the Boysen Dam.
3/ Drainage is located on the Wind River Indian Reservation.
4/ Drainage is on the report area.
5/ Drainage is on the report area and National Forest.

Table 20.- Stream flow records pertaining to the report area, Wind River Basin, Wyoming, 1948 1/

Location River and Station	Period of Record From	-	To	Length of Record (years)	Maximum Discharge (second feet)	Minimum Discharge (second feet)	Average Recorded Total Annual Runoff (acre feet)
Big Horn River at Thermopolis 2/	May 1900 June 1910	Dec. Dec.	1905 1947	42	29,800	162	1,115,470
Wind River near Riverton	May 1906 May 1911 Oct. 1928	Nov. Sept. Dec.	1948 1927 1947	37	12,300	80	731,400
Popo Agie near Riverton	May 1941	Dec.	1947	6	9,360	67	473,640
Little Popo Agie at Hudson	1904		1947	4/	1,490	3/	60,900
North Fork Popo Agie at Lander	1938		1947	4/	1,390	5	73,690
Wind River at Burris (includes North Fork)	1946		1948	3	4,660	192	590,200
Wind River at Dubois	1946		1948	3	904	43	128,300

1/ Water supply of the Missouri River Basin, 1944, U. S. Geological Survey Water Supply Paper No. 1006, and provisional reports of the U. S. Geological Survey, 1945-48.

2/ Represents the flow of the entire Wind River Basin, as only a few minor drainages enter below the basin.

3/ Less than one second foot.

4/ Scattered periods.

Table 21.- Snow depth and water content on Forest Service Courses at headwaters of Popo Agie River, Wind River Basin, 1945-47 1/

	Depth of Snow				Water Content			
	Febr. 1 (inches)	March 1 (inches)	Apr. 1 (inches)	May 1 (inches)	Febr. 1 (inches)	March 1 (inches)	Apr. 1 (inches)	May 1 (inches)
Course 1								
1945	16.3	19.8	16.4	43.2	3.2	4.6	3.6	13.5
1946	15.7	15.5	14.8	0.0	3.1	3.9	4.1	0.0
1947	13.3	14.0	13.5	-	3.5	3.7	4.5	-
Course 2								
1945	17.6	26.4	25.7	62.8	2.6	5.8	6.8	17.4
1946	29.4	30.6	34.9	9.6	6.9	8.1	9.0	3.3
1947	31.7	33.1	36.7	-	8.2	8.5	11.2	-

1/ Course 1 is located in Section 3, T. 31 N., R. 101 W., near the head of Middle Fork Popo Agie River, elevation 8,500 feet.

Course 2 is located in Section 23, T. 31 N., R. 101 W., near the head of Little Popo Agie River, elevation 9,500 feet above sea level.

Table I .- Description and definitions of Land Resource Condition Classes

Condition Class	Principal Characteristics Affecting Condition of Range Resource				
	Soils		Vegetation		
	Fertility	Erosion	Presence or absence of inferior species	Vigor	Relative Productivity
Excellent	Good soil, limited by climatic conditions.	No apparent accelerated soil erosion by wind or water and no recent accumulation of silt or debris.	An absence of "invader" species of inferior utility.	Vigorous condition and good reproduction of the more valuable native vegetation.	Maximum (optimum) or near maximum production of high quality vegetation during normal years.
Good	Slightly reduced soil fertility and loss of organic matter and tilth.	Only very minor accelerated sheet & shoe-string erosion or possibly some blowing and minor accumulations.	Slightly increased abundance of inferior species and "invader" plants.	Slightly reduced vigor and reproduction of desirable native vegetation; decreased density of vegetative cover.	Reduced production to between 75 and 90 percent of optimum.
Fair	Moderately to severely depleted soil fertility; poor tilth.	Advanced accelerated erosion evidenced by some gullies, moderate sheet erosion & topsoil loss.	Predominance of less desirable plants. Decided increase of "invader" species.	Moderately reduced vigor and abundance and little or no reproduction of more desirable native vegetation; generally decreased density of perennial cover.	Reduced productivity to between 50 and 75 percent of optimum.
Poor	Severely depleted soil fertility, poor tilth.	Excessive rapid runoff with heavy silt loam, greatly accelerated soil erosion evidenced gullying; topsoil may be lost, subsoil exposed.	Predominance of inferior perennial species or annual vegetation.	Greatly reduced vigor & density of perennial vegetation; most desirable native species may be absent or have high mortality; reproduction absent.	Productivity reduced below 50 percent of optimum.

Table II.- Description and definitions of land-use capability classes 1/

Class	Suitable for	Topography: Slope (percent)	Topography: Character of surface	Characteristic Native Vegetation	Soil Characteristics: Texture	Soil Characteristics: Depth	Soil Characteristics: Relative Salinity	Soil Characteristics: Fertility	Soil Characteristics: Productivity	Soil Characteristics: Drainage	Vulnerability to Erosion	Requisite Special Practices
I	Best type of farming land.	0 to 2		Tall and midgrasses, thrifty sage, deciduous trees	Medium Friable	12" or more; subsoil 36" or more	Negligible	High	Good to high	Good to excellent	Low	None to minor
II	Farming with simple conservation practices	0 to 10	Irregular	Tall, mid and short grasses; Big sage, deciduous trees	Light to heavy; Friable	8" or more; subsoil 36" or more	Negligible to slight	Good to high	Moderate to high	Good	Slight to moderate	Minor to simple practices
III	Farming with complex conservation practices	0 to 10	Irregular	Tall, mid and short grasses; Big sage, rabbit brush, greasewood, coniferous and deciduous treee	Light to heavy; Friable	6" or more; subsoil 24" or more	Slight to moderate	Fair to good	Moderate to high with management	Often poor; may be needed	Moderate to high	Complex practices essential
IV	Limited or occasional cultivation; best for permanent hay or pasture	0 to 15	Irregular or stony	Tall, mid and short grasses; Big sage, raobit brush, greasewood, coniferous, deciduous trees, salt bush, winter fat and yellow brush	Sandy to clay; porous or tight	6" or more; may have shallow hardpan	Negligible to critical	Poor to good	Poor for row crops; best for hay and pasture	Not justifiable if needed	Moderate to high	Complex and intensive practices with good management
V	Range or woodland; farming only if irrigation water becomes available	0 to 5	Smooth to irregular; may be stony	Tall, mid and short grasses; Big sage, rabbit brush, greasewood, coniferous and deciduous trees. Density .3 or more	Light to heavy; Friaole	Good permeability to 24" depth	Negligible to moderate	Good to high	Moderate to high; not over three acres per A. U. M.	Usually not a problem	Low	None to minor
VI	Range and woodland only	0 to 20 (greater only on good soils)	Irregular to rough or rocky	Tall, mid and short grasses; Big sage, rabbit brush, greasewood, coniferoue, deciduous trees, salt bush, winter fat and yellow brush. Density .3 or more	Very light to heavy	Shallow to moderate; permeability excessive to poor	Negligible to moderate	Fair to good	Light to moderate; 3-10 acres per A.U.M.	Not practicable if a problem	Moderate	Proper management with simple restrictions
VII	Range and woodland with severe restrictions	0 to 100	Rough, rocky or eroded	Tall, mid and short grasses; Big sage, rabbit brush, greasewood, coniferous, deciduous trees, salt bush, winter fat, yellow brush, mountain browse and annuals. Density under .3	Usually tight clay or open sand or gravel	Usually shallow poorly developed	Negligible to critical	May be poor	Poor to light; over 10 acres per A.U.M.	Seldom a problem or not practicable	High	Proper management with complex restrictions & intensive practices
VIII	Watershed, wildlife and recreation	Generally steep	Extremely rough, barren or inaccessible	Often only annuals or scanty perennials; may be dense coniferoue timber	Usually poorly developed	Very shallow or nil	May be excessive for plant growth	Usually very low	Usually very low or nil	Often poor; not justifiable if a problem	High (unless a swamp)	Complete protection

1/ Adapted from Soil Conservation Service Standards, U. S. Department of Agriculture. Any one of the factors listed may classify a soil, factors determining classification singly and not necessarily in combination.

Table III .- Description and definitions of soil erosion condition classes

Erosion Class	Description of degree of erosion	Sheet Erosion	Wind Erosion	Gully Erosion
1	None to Slight	0-10 percent of topsoil removed. Little apparent evidence of surface erosion and then only localized areas too small to delineate into Class 2. Vegetation often climax type. Generally smooth to gently undulating plains and forested lands; dominantly 0-3 percent slopes.	None to only local evidence of slight soil drift or surface soil removal. 0-10 percent of topsoil removed. Soil usually well protected by sod or plant litter.	No evidence of active gullying. All waterways well established.
2	Slight to Moderate	10-25 percent of topsoil removed, but with little evidence of vegetation breaking up. Slopes generally moderate; characterized by climax type of vegetation with few annual weeds and of usually lower density than vegetation in Class 1 above.	Local evidence of slight to moderate soil drifting and surface soil removal and/or accumulation. Most soil types, particularly the silty and fine sandy textured soils under certain conditions of culture and drought combined with high winds, are subject to this form of soil deterioration.	Occasional active gullies which are usually shallow, occuring primarily along main watercourses at intervals of more than 100 feet. In open areas and where slopes permit, little difficulty in traversing the area in a car.
3	Moderate to Severe	25-50 percent of topsoil removed. "Cat steps" and terraces noticeable on slopes which may be moderate to steep. Bare spots are quite common. Undesirable weeds and plants are beginning to dominate the vegetation with climax types more often scattered than dominant. Perennial woody plants frequently pedestalled. Subsoil rarely exposed except in localized areas.	Bare spots common and areas generally more consistently subject to damage by soil blowing. Soils often removed to depths of 1 to 4 inches and drift accumulations and hummocks noticeable. Sod grass deterioration and plant pedestals in evidence and plant cover is insufficient for soil protection. Subsoil occasionally exposed and soils containing gravel show pavement appearance.	Occasional gullies shallow or deep occuring at intervals of more than 100 feet apart. Concentration of run-off and drainage channeling generally due to steepness of slope. Main water courses deeply channeled, generally U-shaped with tributaries usually V-shaped. Moderate difficulty in traversing area in car, ordinarily having to "head" gully in crossing. Generally associated with extensive shoe-string or rill gullying.
4	Severe to Critical	50-100 percent of topsoil removed and subsoil may be exposed in many places and is being removed to varying depths. Bare spots and trampled out areas common and plant pedestalling and erosion pavement highly evidenced. Loss of surface soil may be complete, associated with active gullying and high mortality of climax species of vegetation. Annual and perennial invaders may dominate the vegetation.	Majority of topsoil may be removed; usually accompanied by destructive accumulations in form of hummocks and dunes particularly along such obstructions as fences and edges of drainageways. Perennial vegetation often scanty and extensively pedestalled.	Frequent, usually shallow, gullies occuring at intervals of less than 100 feet apart. Main waterways deeply channeled and undergoing active gullying, usually U-shaped. Areas often incised by shoestring gullies and rills but are not generally so numerous or deep as to destroy the land completely but dissection permits rapid drainage of surface water. Corduroyed surface makes car travel impossible.
5	Critical to Extreme	Usually all the surface soil has been removed and utility and productivity of land has been largely destroyed by advanced stages of gully erosion which usually continues and retirement from use is, therefore, mandatory. Barren wastelands are often in this class. Desirable perennials never have occupied the area or have been practically obliterated and low density of annuals usually predominates.	Represents a condition of soil deterioration amounting to essential destruction. Retirement from further use is mandatory and artificial treatment is often essential to soil stabilization. Constantly shifting dunes are common. Deep fine sandy soils usually predominate in areas so classified.	Frequent and deep gullies. Generally represents maximum destruction by erosion. Complete and rapid drainage of surface water and soil moisture effected through intricate dissection of soil by gullies. Deeply channeled waterways with edges broken and caved in. Gully banks, slopes and bottoms in active erosion stage.

Table IV.- Reference list of federal range allottees and public domain lessees in the report area, Wind River Basin, Wyoming, June, 1948 1/

Map No.	Name	Map No.	Name	Map No.	Name
			DUBOIS SUB-AREA		
1	Alexander, Morrie	14	Henthorne, Max C.	27	Spencer, Dean
2	Anderson, John	15	Johnson, Nicholas W.	28	Stalnaker, Floyd J.
3	Amoretti, Eloise	16	Leseberg, W. B.	29	Stock, Claude D.
4	Angle, Albert and Bertha	17	Miller, Cloyd L.	30	Stringer, Paul H.
5	Beck, Charles B.	18	Moore, Marion L.	31	Torrey Lake Ranch
6	Beck, Russell B.	19	Mockler, Earl C.	32	Wadleigh, A. C.
7	Bermingham, E. J. and K.	20	Mockler, Frank C.	33	Warnock, William Leon
8	Cross, George	21	Nowlin, Percy	34	Weeks, Ben
9	Duncan, Tom	22	Peck, George A.	35	Williams, G. A.
10	Duncan, William L.	23	Riggs, Claude W.	36	Winchester, John and Albert
11	Dyke, George E.	24	Rocking Chair Ranch	37	Wyoming Fish and Game Commission
12	Green, Manley	25	Scott, Foster S.		
13	Harrison, W. N.	26	Shipley, Don		
			LANDER-MUSKRAT-BADWATER SUB-AREA		
1	Anesi, Rosa	74	*Homec, Albert J.	147	Thompson, Joe
2	Appleby, A. C.	75	Hopkins, Byran L.	148	Van Patton, Luella
3	Armstrong, John (See No. 181)	76	Hornecker, John M.	149	Waggoner, Lon
4	Arnold, J. C.	77	Hornecker, Ora M.	150	Walker, James
5	Arthur, Orley	78	Iiams, C. B.	151	Wight, Guy
6	Auer, John, Estate	79	Iiams, James	152	Wingfoot Sheep Company
7	Baldwin, C. E.	80	Iiams, Roy	153	Yellowstone Sheep Company
8	Barr, Robert	81	Jack, William C., et al	154	Price, Ed.
9	Bighorn Sheep Company	82	Jammerman, Albert	155	Barnes, C. E.
10	Blair, Percy C.	83	Jenkins, Charles	156	Chapman, Raymond
11	Picard, Ray	84	Johnston, Raymond	157	Lander Valley Farmer's Association
12	*Booth, J. C.	85	Johnston Sheep Company	158	Parker, A. P.
13	Bowman, R. E.	86	Kanson, Omar	159	Woolery, E. T. and Son
14	*Bringolf, Hans	87	Keystone Sheep Company	160	Woolery, Ray
15	Brown, Orley R.	88	Kierman, John	161	Alborn, Mary Okie et al
16	Busch, Harold H.	89	King, Leon M.	162	Allen, Lloyd
17	Burgess, Howard J.	90	Krone, H. and Mike Mohr	163	Berger
18	Calvert, Fred	91	Lee, John	164	Brandon, W. H.
19	Calvert, Kirk	92	Lockard, H. R.	165	Brenman, Frank and Son
20	Calvert, Lloyd	93	Lozier (See Ben Cockran)	166	Brenner, Curt R.
21	Campbell, Murdo	94	Macfie, William	167	Brittian, O. R.
22	Carlson, A. J.	95	Mackenzie, Brothers	168	Bryan, Ray O.
23	Clayton, Emma F.	96	Mann, Bessie D.	169	Canning, Roy O.
24	Clayton, Mattie Lee	97	*Matheson, Marion and Gillis	170	Cantril, Jack et al
25	Cooley, Hugh O. and Stella D.	98	Matheson, Walter	171	Cassil, T. T.
26	Connett, Mrs. M.	99	*Mazet, Camille	172	Cassil, Ramage and Barclay
27	Corbett, Marian	100	Meigh, Robert	173	Clapp, A. F.
28	Cottonwood Sheep Company	101	*Meredith, Frank	174	Cunningham, G.
29	Croft, Paul	102	Merriam Sheep Company	175	Davis, George A.
30	Davis, W. Floyd	103	Miles, James N.	176	Davison, Willis A.
31	*Davison, Brothers	104	Mills, Sanford	177	Day, John and Sons
32	Deal, Oscar	105	Miller, Claude C.	178	Edwards, H. Mark
33	Diamond Ring	106	Mohr, Mike	179	Ellis, Michael and Tom
34	Donaldson, W. W.	107	Mohr, Mike & Joe Peterson	180	Fuller, Douglas, Sr.
35	Dorr, Robert C.	108	Montgomery, John Russell	181	Fuller, George and Caroline
36	Double S. Sheep Company	109	Morris, Joseph W.	182	Gardner, C. H.
37	Downey, George R.	110	*Mund, William	183	Gourley, Harry
38	Duthie, Warren H.	111	Myers, Sophia	184	Graham, Walter G.
39	*Ellis, W. H.	112	Nalls, Stuart	185	Gross, B. H.
40	Ellis, W. K.	113	Neff, L. R.	186	Harvard, Fred et al
41	Farlow, Albert J.	114	Noble, Mrs. K. M.	187	Howard, J. and E.
42	*Farlow, E. J.	115	Norman, G. A.	188	Humphreys, T. and M.
43	Figure 8 Sheep Company	116	Nunn, Mary A.	189	L. L. Sheep Company
44	Fremont Sheep Company	117	Obert, Carl	190	Lichtenstein, Charles B.
45	French Livestock Company	118	Oceanas, Joe	191	Lichty, Orin
46	*Gabus, Fred	119	Oldham, Charles H., Jr.	192	Logan, Floyd
47	Garner, Harry	120	Oldham, Charles H., Sr.	193	Lybyer, Leonard
48	Garrison, William F.	121	Ore, Argil	194	Mack, W.
49	George, David	122	Peterson, Francis H. & Silas E. Clark	195	Miller and Jack
50	*Givens, Don	123	Peterson, Joe	196	Mudge, B. W.
51	*Givens, George	124	Peterson, William	197	Pratt, W. F.
52	Greenough, Brothers	125	Piper, Giles Marcus	198	Ramage, George, Estate
53	Grieve, Clarence	126	*Pietro, Paul	199	Ramage, William
54	*Griffin, Brothers	127	*Posey, Jess	200	Rate, Frank
55	Grigg, Ed and Harriet	128	Poston Sheep Company	201	Reed, C.
56	*Grigg, Helen	129	Rader, Mattie B.	202	Robison, Donald M. et al
57	Gustin, Ed	130	Ranney, Charles H.	203	Schoening, David
58	Hall, Claire	131	*Reuber, William, Jr.	204	Spratt, R. W. and Sons
59	Hallam, Alvin H.	132	Roberts, Ben	205	Sullivan, Steve F.
60	Hallam, Frank	133	Robertson, W. A.	206	Thoren, D. A.
61	Hancock, Dale	134	Rochelle, Kathleen	207	Todd, B. D.
62	Hancock, Frank	135	Schmoyer, Ruby	208	Twidale, J. W. and Son
63	Hancock, J. Jefferson	136	Scybert, Winnie and T. H.	209	Vee Bar
64	Hancock, James K.	137	Silber, James L.	210	Westfall, Perry
65	Hancock, Rhett	138	South Pass Land and Livestock Company	211	Pratt, W. F.
66	Hardin, W. E.	139	Spearhead Sheep Company	212	Robson and Scott
67	Hart, Lawrence T.	140	Spencer, Otho D.	213	Carlson, A. R.
68	Hart, Wheatley	141	Spriggs, John J.	214	Mahoney, P. S.
69	Heaney, Thomas B.	142	*Sproule and Coen	215	Sullivan, Jeremiah
70	Henrickson, A.	143	Sprout, Forest and Ford	216	Oakie, William R.
71	Henton, Elisha	144	Steers, Roy J. et al	217	Bloomquist, Arvid
72	*Herbst, Frank and Anton	145	Stepp, Margaret	218	Wynn, Bruce
73	Home Sheep Company	146	Strohecker, Louis		

*Permittees or licensees of Wind River Grazing District whose base properties are all or in part, within the Riverton Irrigation Project or the Wind River Indian Reservation.

1/ To be used in conjunction with Present Land Tenure and Operating Unit Map No. 4; compiled from case file records of the Wind River Grazing District #2 Office, Lander, Wyoming.

LEGEND

BOUNDARIES

- COUNTY
- RESERVATION

WORKS AND STRUCTURES

- HARD SURFACED ROAD
- GRAVELED ROAD
- IMPROVED DIRT ROAD
- UNIMPROVED DIRT ROAD
- TOWNS
- HOUSE — ABANDONED
- SCHOOL
- POWER PLANT
- CEMETERY
- MINE — ABANDONED
- OIL OR GAS WELL
- WATER WELL
- ARTESIAN WELL
- CORRAL
- LANDING FIELD
- WINDMILL
- SPRING — DEVELOPED
- RESERVOIR
- CHECK DAM
- CANAL
- CROPLAND
- CATTLE GUARD
- BARRIER
- RESEEDING (RE 100 A)
- FIRE TOOL CACHE
- DESILTING BASIN
- CONTOUR FURROWING
- RAILROAD FENCED
- WATER SPREADING
- FENCE
- POWER TRANSMISSION LINE
- PIPE LINE
- RAILROAD
- TELEPHONE LINE

DRAINAGE

- STREAMS
- INTERMITTENT STREAM
- RIVER
- LAKE
- PROPOSED RESERVOIR

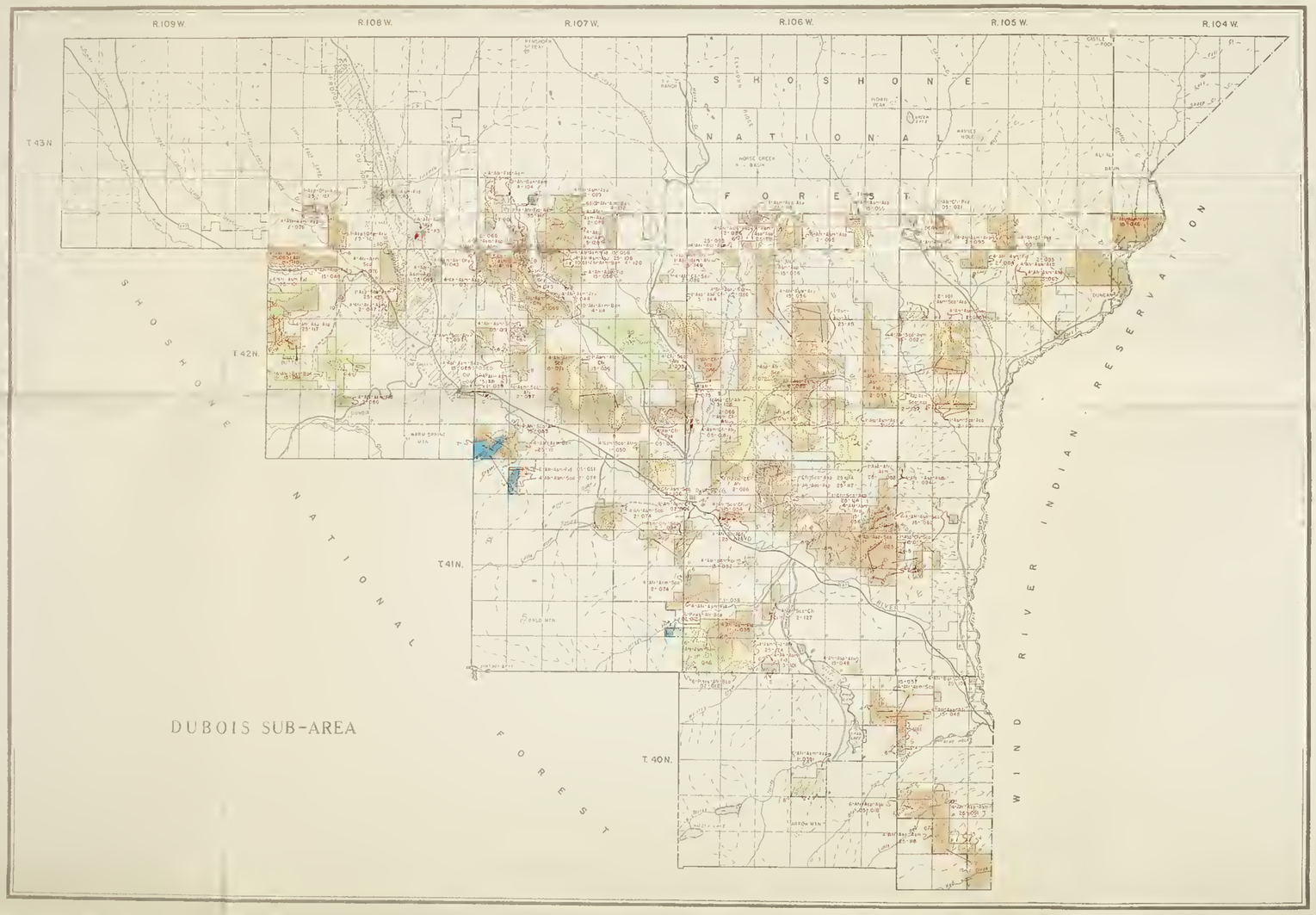
STATUS

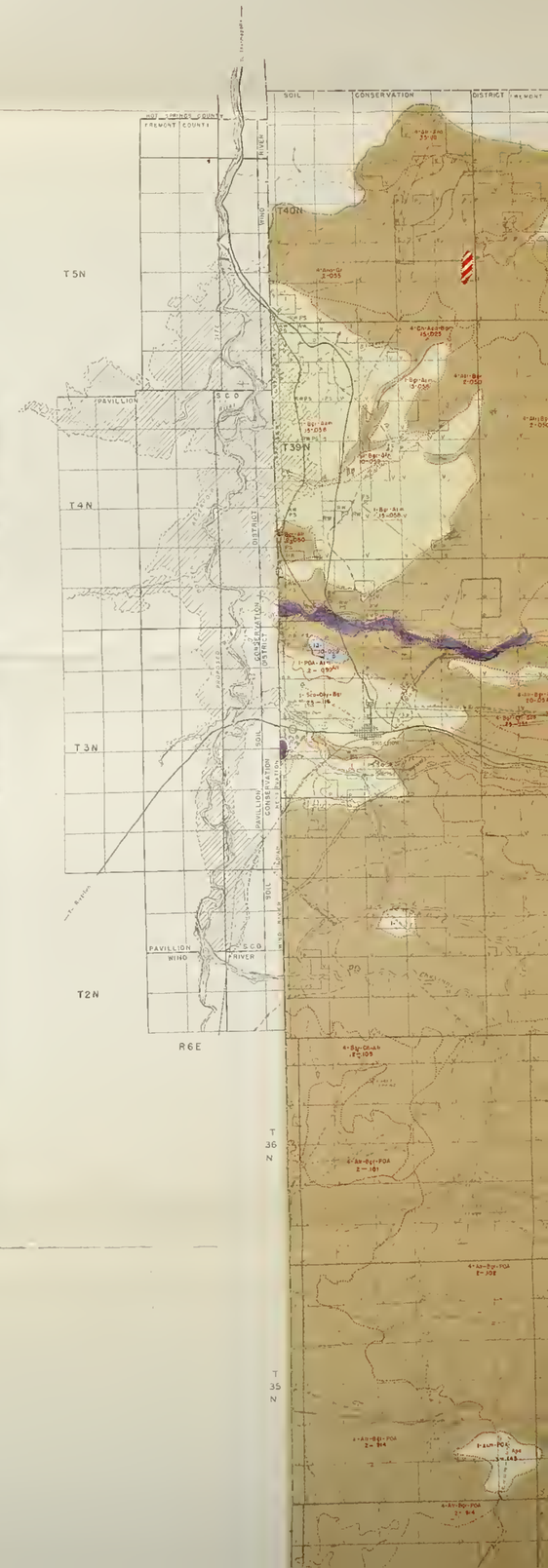
- S—STATE
- V—VACANT
- P—PRIVATE
- PS—POWER SITE
- RW—RECLAMATION WITHDRAWAL
- PWR—PUBLIC WATER RESERVE

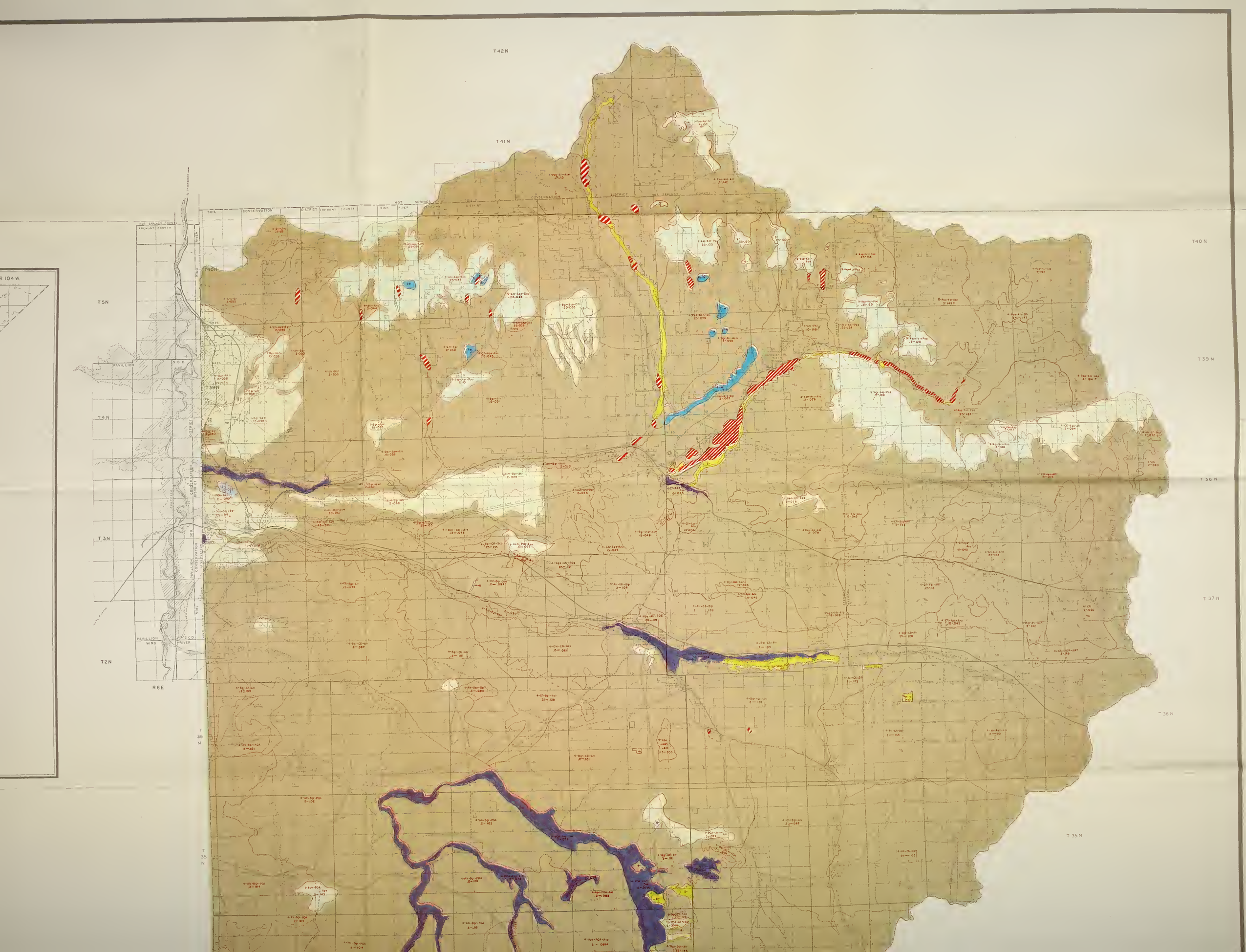
VEGETATION COLOR LEGEND

TYPE NO.

- 1—(GRASS)
- 2—(MEADOW)
- 3—(WEEDS)
- 4—(SAGEBRUSH)
- 5—(BROWSE-SHRUB)
- 6—(CONIFER)
- 7—(WASTE)
- 8—(BARREN)
- 9—(PINON JUNIPER)
- 10—(BROAD-LEAF)
- 13—(SALTBRUSH)
- 14—(GREASEWOOD)
- C—(CULTIVATION)






T42N
T41N
T40N
T39N
T38N
T37N
T36N
T35N
T5N
T4N
T3N
T2N
R6E
R104W.
HOT SPRINGS COUNTY
FREMONT COUNTY
SOIL CONSERVATION DISTRICT
WIND RIVER
PAVILLION
PAVILLION WIND RIVER SOIL CONSERVATION DISTRICT

PS POWER SITE

RW RECLAMATION WITHDRAWAL

PWR PUBLIC WATER RESERVE

VEGETATION COLOR LEGEND

TYPE NO.

1—(GRASS)

2—(MEADOW)

3—(WEEDS)

4—(SAGEBRUSH)

5—(BROWSE-SHRUB)

6—(CONIFER)

7—(WASTE)

8—(BARREN)

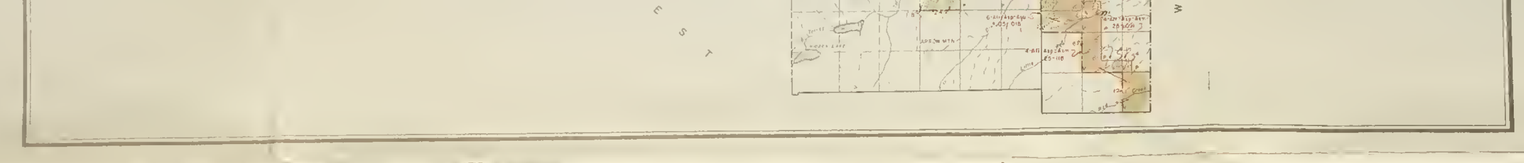
9—(PINON JUNIPER)

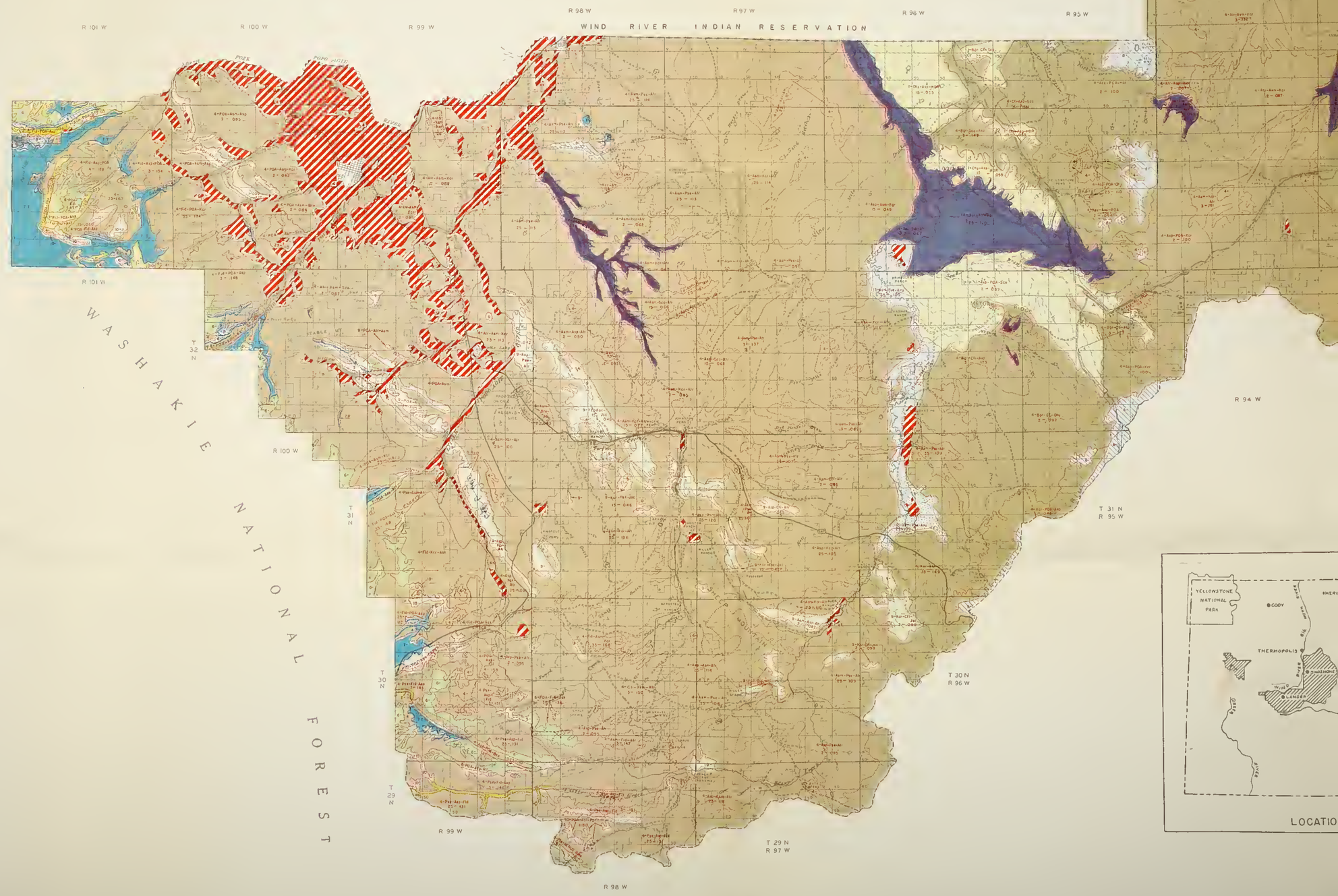
10—(BROAD-LEAF)

13—(SALTBRUSH)

14—(GREASEWOOD)

C—(CULTIVATION)





BRADFORD-ROBINSON PRINTING CO


T 36 N
T 35 N
T 34 N
R 88 W
T 33 N
T 32 N
T 90 W
T 32 N
R 89 W
R 88 W
R 96 W
R 95 W
R 94 W
R 93 W
R 92 W
R 91 W
T 31 N
R 95 W
T 30 N
R 96 W
ESERVATION
BEAVER
YELLOWSTONE NATIONAL PARK
CODY
SHERIDAN
THERMOPOLIS
NEW CASTLE
CASPER
CHEYENNE
LOCATION MAP
UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
DIVISION OF PLANNING
WIND RIVER SUB-AREA
WYOMING
VEGETATION TYPE MAP
MISSOURI RIVER BASIN INVESTIGATION
BILLINGS, MONTANA
BILLINGS DRAFTING OFFICE

MAP NO. 1 OF 5

LEGEND

BOUNDARIES

- COUNTY
- RESERVATION

WORKS AND STRUCTURES

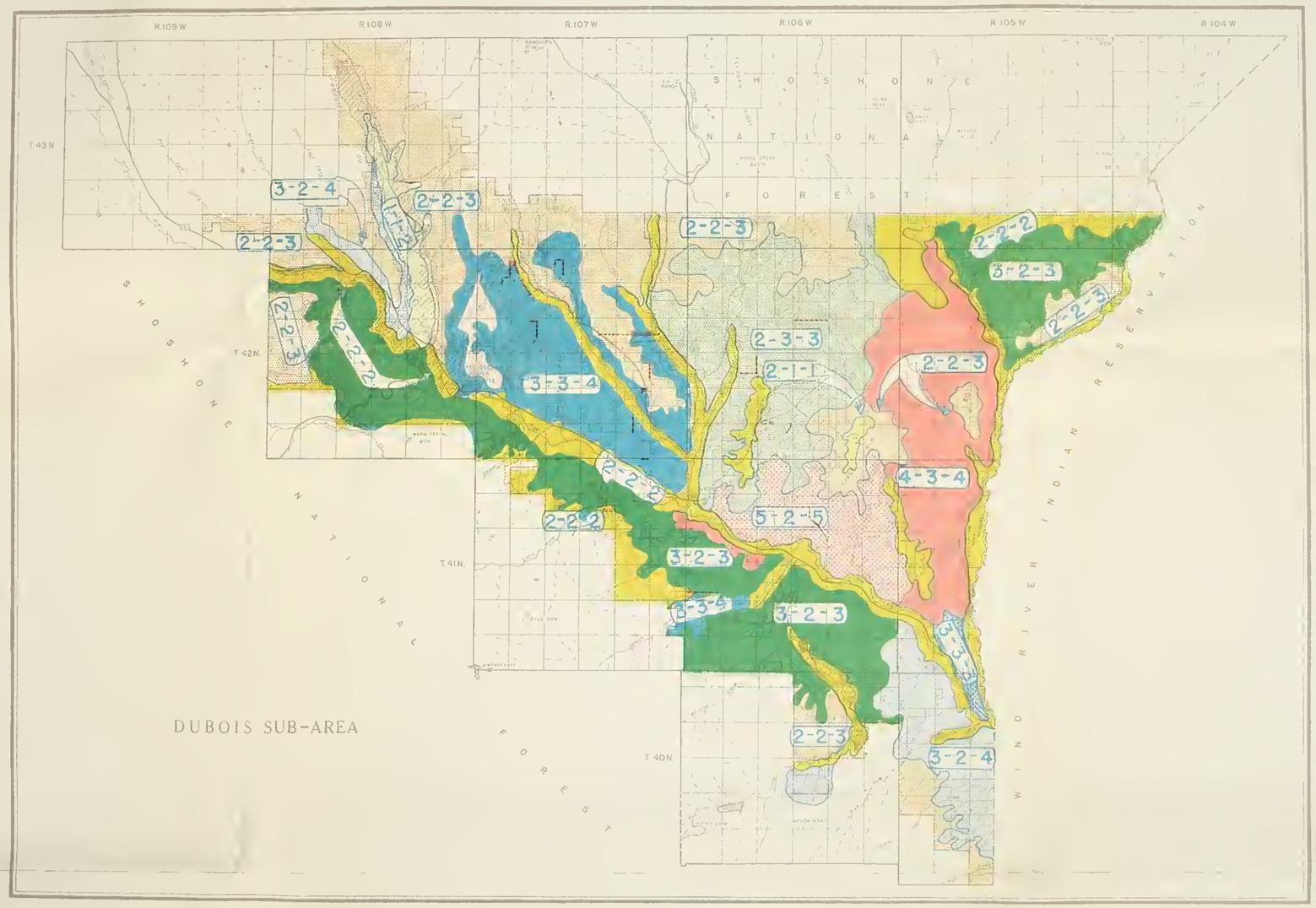
- HARD SURFACED ROAD
- GRAVELED ROAD
- IMPROVED DIRT ROAD
- UNIMPROVED DIRT ROAD
- TOWNS
- HOUSE — ABANDONED
- SCHOOL
- POWER PLANT
- CEMETERY
- MINE — ABANDONED
- OIL OR GAS WELL
- WATER WELL
- ARTESIAN WELL
- CORRAL
- LANDING FIELD
- WINDMILL
- SPRING — DEVELOPED
- RESERVOIR
- CHECK DAM
- CANAL
- CROP LAND
- CATTLE GUARD
- FARRIER
- RESEEDING
- FIRE TOOL CACHE
- DESILTING BASIN
- CONTOUR FURROWING
- RAILROAD FENCED
- WATER SPREADING
- FENCE
- POWER TRANSMISSION LINE
- PIPE LINE
- RAILROAD
- TELEPHONE LINE

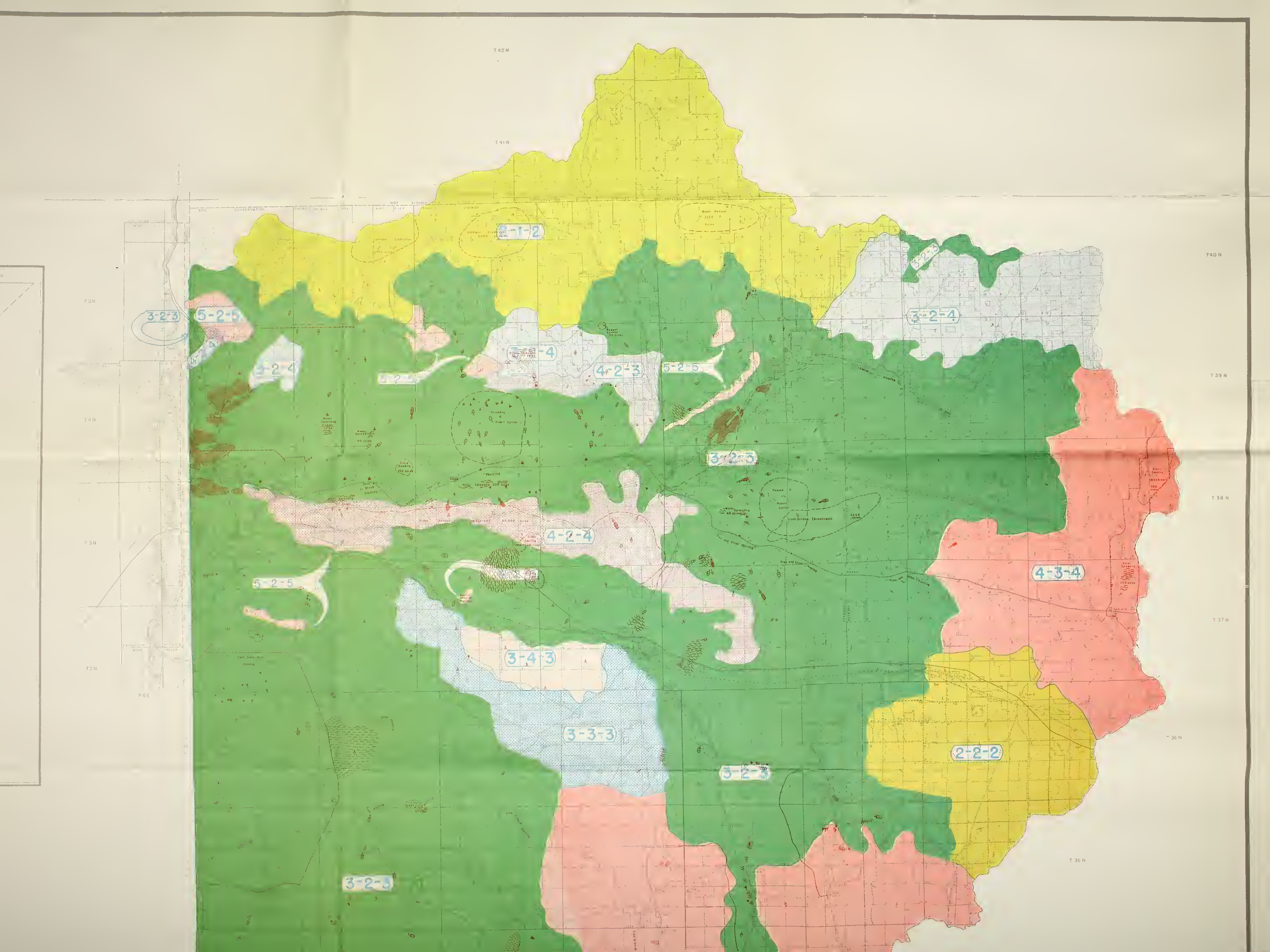
DRAINAGE

- STREAMS
- INTERMITTENT STREAM
- RIVER
- LAKE
- PROPOSED RESERVOIR

STATUS

- S—STATE
- V—VACANT
- P—PRIVATE
- PS—POWER SITE
- RW—RECLAMATION WITHDRAWAL
- PWR—PUBLIC WATER RESERVE

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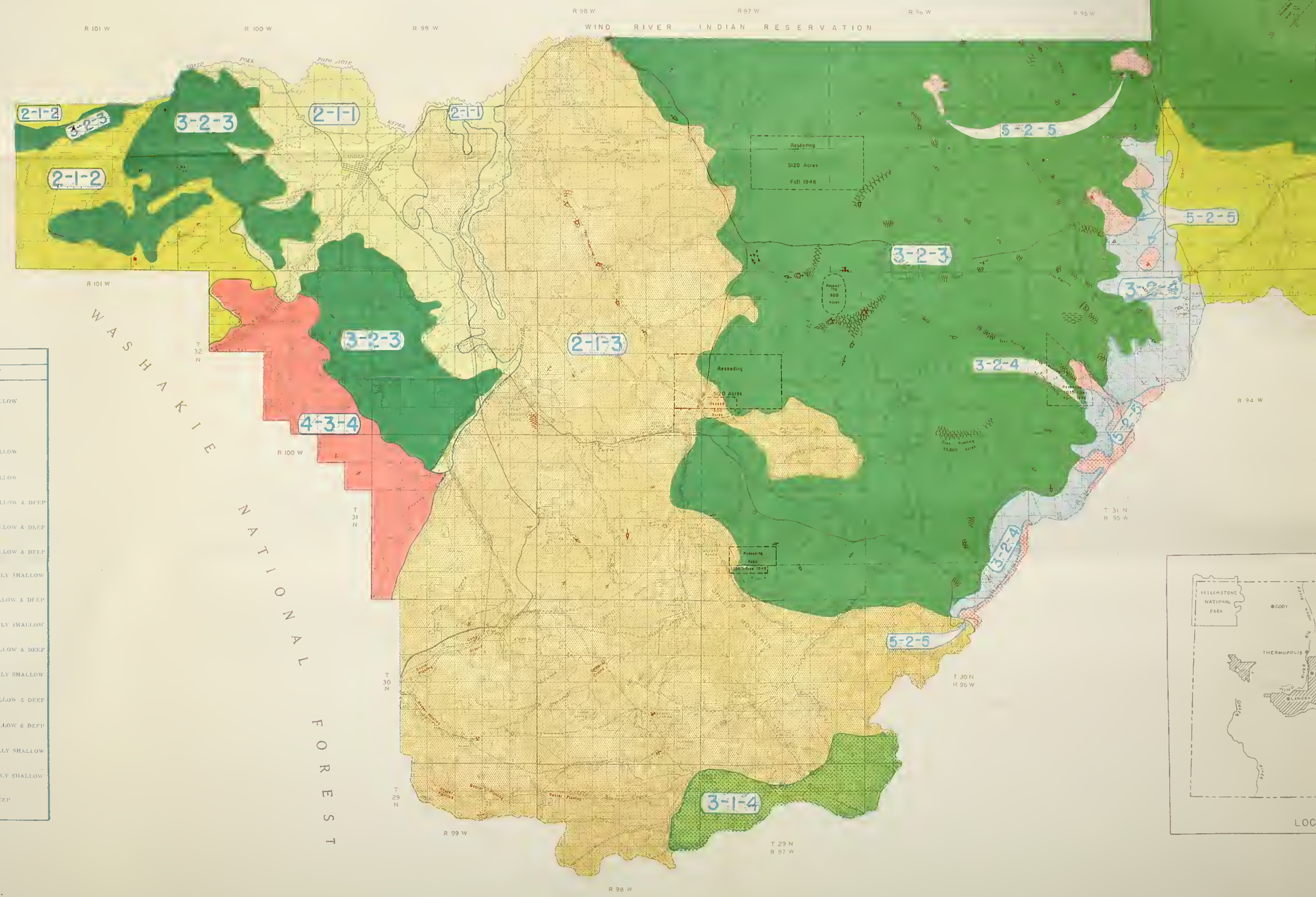
T39N
T38N
T37N
T36N
T35N
T5N
T4N
T3N
T2N
R6E
2-1-2
3-2-3
5-2-5
3-2-4
4-2-3
5-2-5
3-2-3
4-2-4
5-2-5
3-4-3
3-3-3
3-2-3
3-2-3
4-3-4
2-2-2

PS POWER SITE

RW RECLAMATION WITHDRAWAL

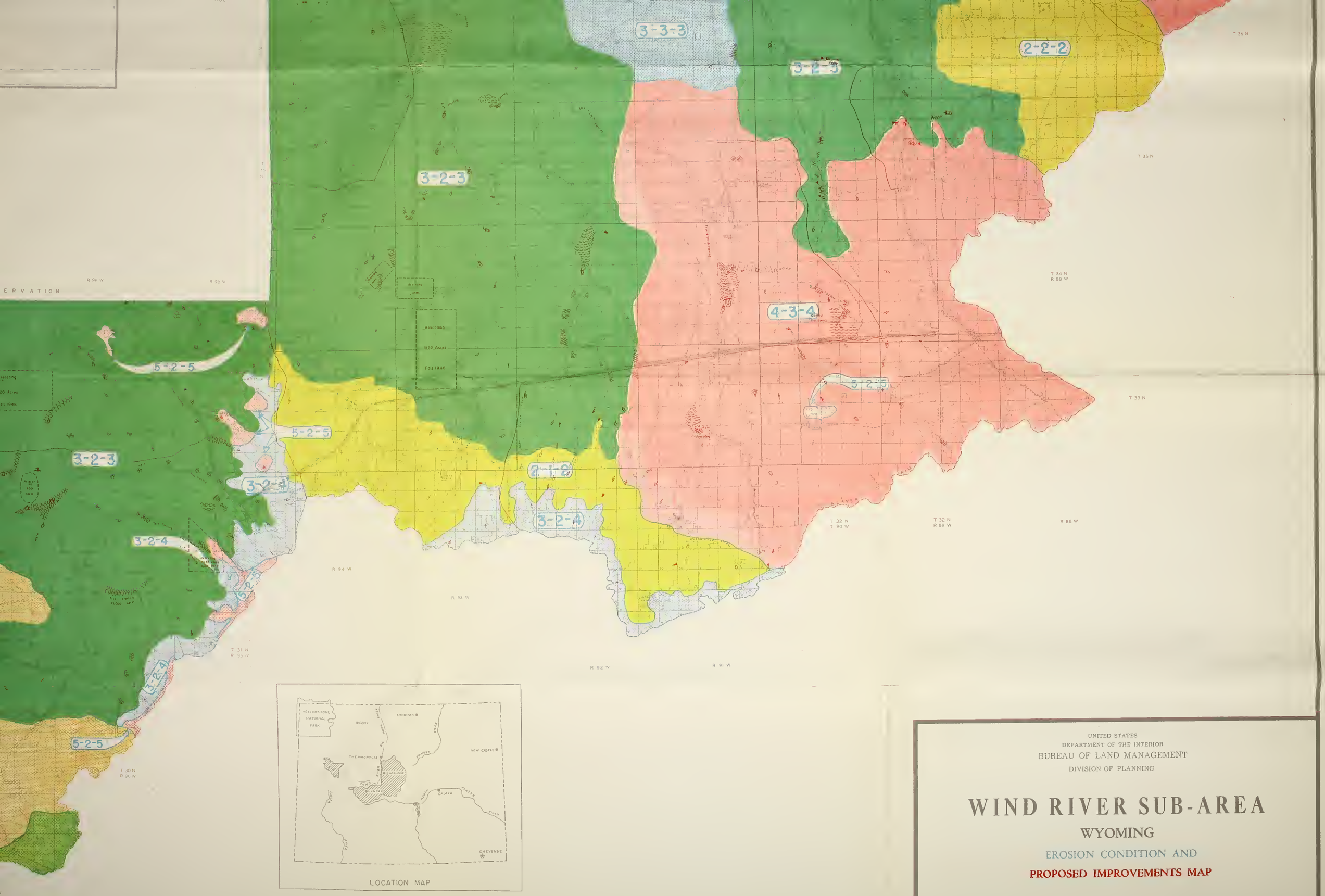
PWR PUBLIC WATER RESERVE



LEGEND

DEGREE OF EROSION	CLASS OF EROSION		
	SHEET	WIND	GULLY
1-1-2	NONE TO SLIGHT	NONE TO SLIGHT	OCCASIONAL, SHALLOW
2-1-1	SLIGHT TO MODERATE	NONE TO SLIGHT	INFREQUENT
2-1-2	SLIGHT TO MODERATE	NONE TO SLIGHT	OCCASIONAL, SHALLOW
2-2-2	SLIGHT TO MODERATE	SLIGHT TO MODERATE	OCCASIONAL, SHALLOW
2-1-3	SLIGHT TO MODERATE	NONE TO SLIGHT	OCCASIONAL, SHALLOW & DEEP
2-2-3	SLIGHT TO MODERATE	SLIGHT TO MODERATE	OCCASIONAL, SHALLOW & DEEP
2-3-3	SLIGHT TO MODERATE	MODERATE TO SEVERE	OCCASIONAL, SHALLOW & DEEP
3-1-4	MODERATE TO SEVERE	NONE TO SLIGHT	FREQUENT, USUALLY SHALLOW
3-2-3	MODERATE TO SEVERE	SLIGHT TO MODERATE	OCCASIONAL, SHALLOW & DEEP
3-2-4	MODERATE TO SEVERE	SLIGHT TO MODERATE	FREQUENT, USUALLY SHALLOW
3-3-3	MODERATE TO SEVERE	MODERATE TO SEVERE	OCCASIONAL, SHALLOW & DEEP
3-3-4	MODERATE TO SEVERE	MODERATE TO SEVERE	FREQUENT, USUALLY SHALLOW
3-4-3	MODERATE TO SEVERE	SEVERE TO CRITICAL	OCCASIONAL, SHALLOW & DEEP
4-2-3	SEVERE TO CRITICAL	SLIGHT TO MODERATE	OCCASIONAL, SHALLOW & DEEP
4-2-4	SEVERE TO CRITICAL	SLIGHT TO MODERATE	FREQUENT, USUALLY SHALLOW
4-3-4	SEVERE TO CRITICAL	MODERATE TO SEVERE	FREQUENT, USUALLY SHALLOW
5-2-5	CRITICAL TO EXTREME	SLIGHT TO MODERATE	FREQUENT AND DEEP

BRADFORD-ROBINSON PRINTING CO



UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
DIVISION OF PLANNING

WIND RIVER SUB-AREA

WYOMING

EROSION CONDITION AND

PROPOSED IMPROVEMENTS MAP

MISSOURI RIVER BASIN INVESTIGATION
BILLINGS, MONTANA
MARCH 1949

BILLINGS DRAFTING OFFICE

MAP NO. 2 OF 5

LEGEND

BOUNDARIES

- COUNTY
- RESERVATION

WORKS AND STRUCTURES

- HARD SURFACED ROAD
- GRAVELED ROAD
- IMPROVED DIRT ROAD
- UNIMPROVED DIRT ROAD
- TOWNS
- HOUSE — ABANDONED
- SCHOOL
- POWER PLANT
- CEMETERY
- MINE — ABANDONED
- OIL OR GAS WELL
- WATER WELL
- ARTESIAN WELL
- CORRAL
- LANDING FIELD
- WINDMILL
- SPRING — DEVELOPED
- RESERVOIR
- CHECK DAM
- CANAL
- CROPLAND
- CATTLE GUARD
- BARRIER
- RE 100 A — RESEEDING
- FIRE TOOL CACHE
- DESILTING BASIN
- CONTOUR FURROWING
- RAILROAD FENCED
- WATER SPREADING
- FENCE
- POWER TRANSMISSION LINE
- PIPE LINE
- RAILROAD
- TELEPHONE LINE

DRAINAGE

- STREAMS
- INTERMITTENT STREAM
- RIVER
- LAKE
- PROPOSED RESERVOIR

STATUS

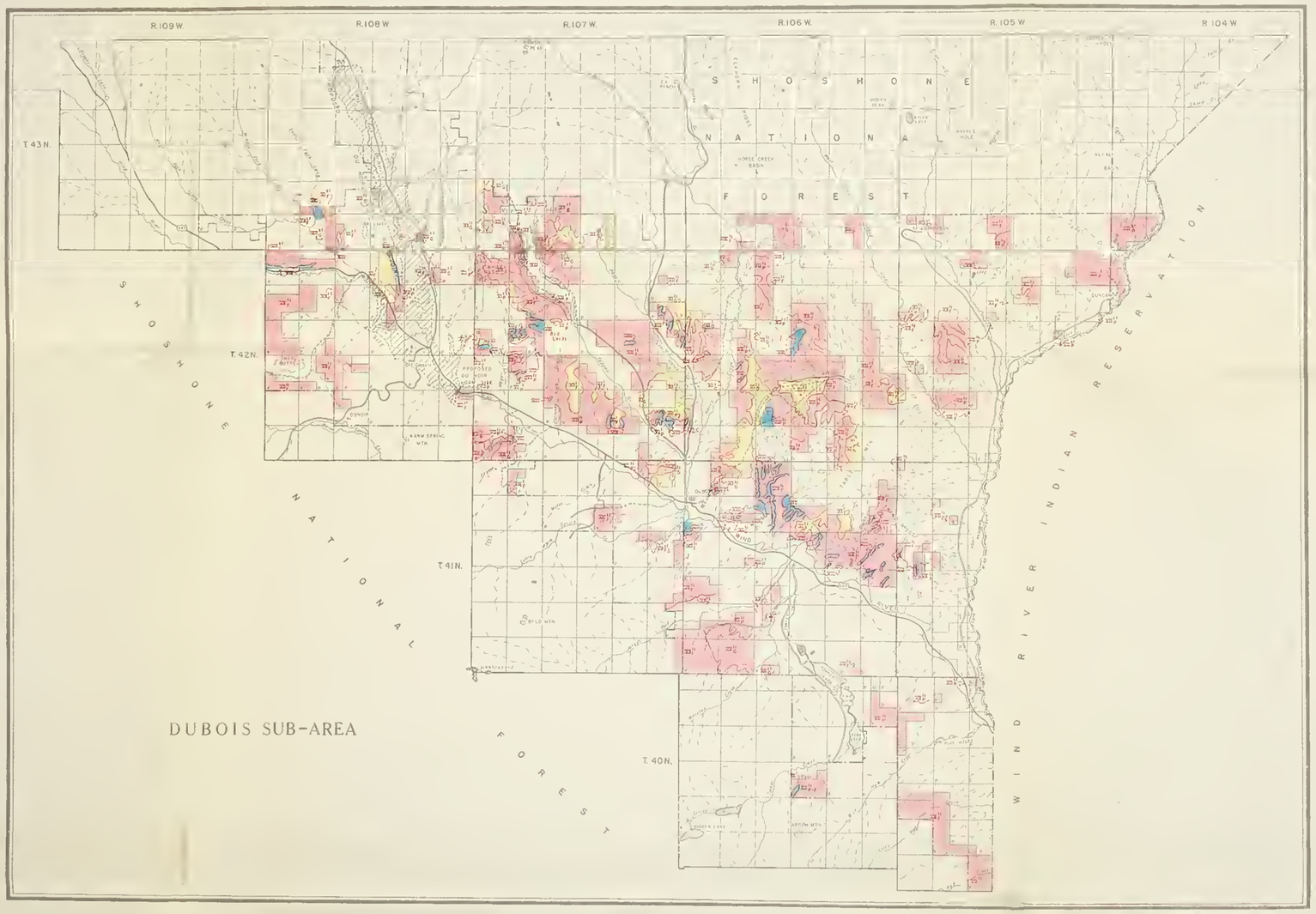
- S—STATE
- V—VACANT
- P—PRIVATE
- PS—POWER SITE
- RW—RECLAMATION WITHDRAWAL
- PWR—PUBLIC WATER RESERVE

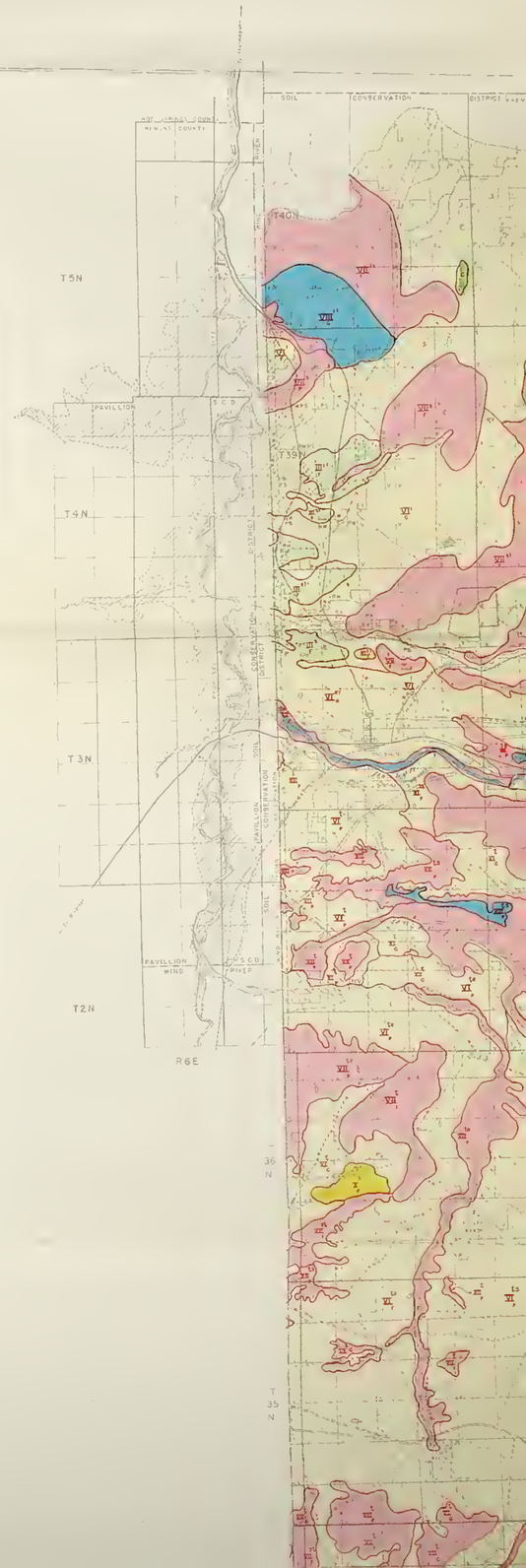
CAPABILITY COLOR LEGEND

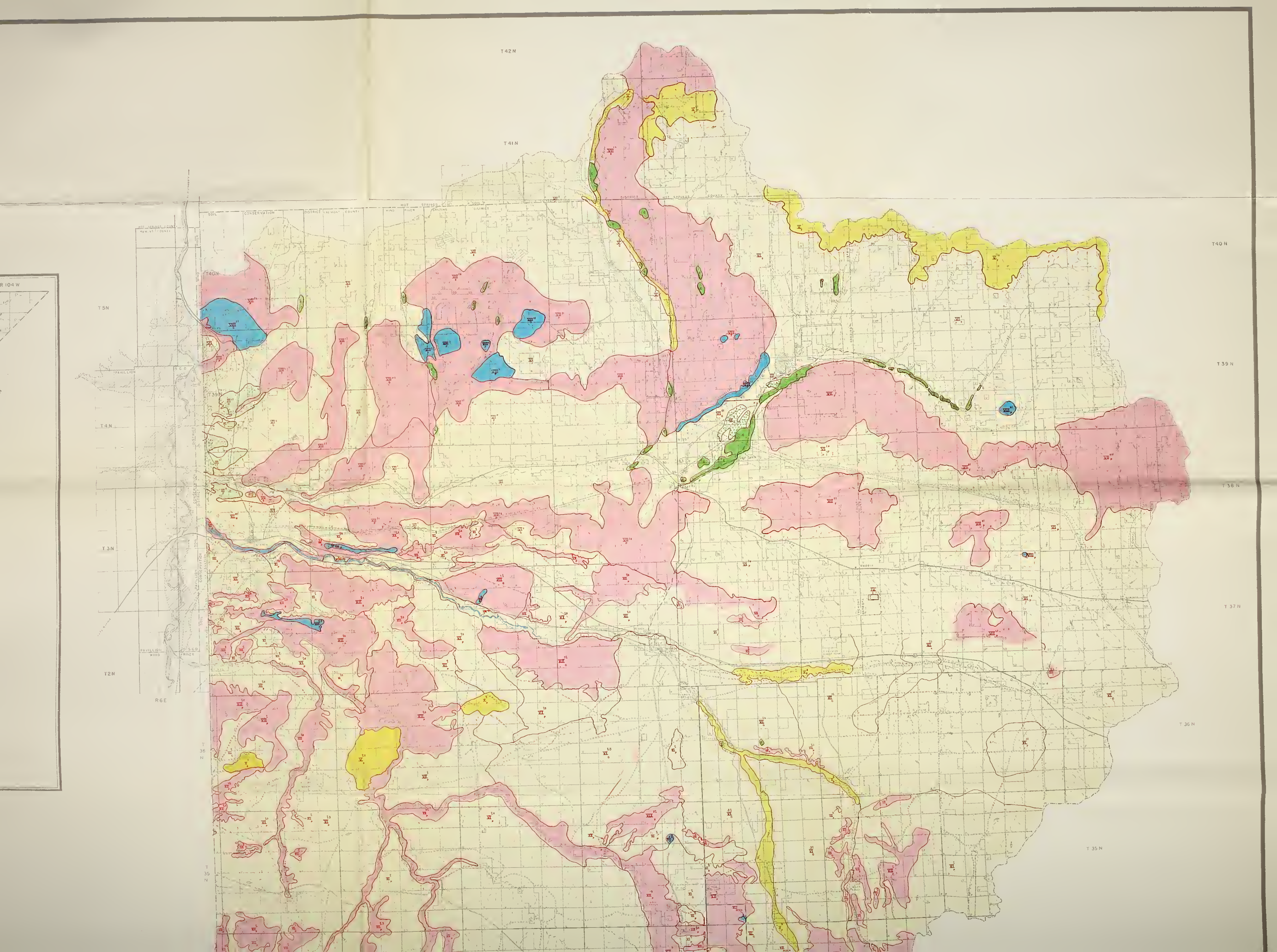
CLASS NO.

- CULTIVATION
- ARABLE LANDS: I, II, III, IV
- GRAZING LANDS: V, VI, VII
- WASTE OR BAD LANDS: VIII

NOTE: REFER TO TEXT FOR CLASS DEFINITIONS



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T40N
T39N
T38N
T37N
T36N
T35N
T5N
T4N
T3N
T2N
R6E
R104W
SOIL CONSERVATION DISTRICT
HOT SPRINGS COUNTY
WIND RIVER GRAZING DISTRICT
PAVILLION
PAVILLION WILD
S.C.D. RIVER

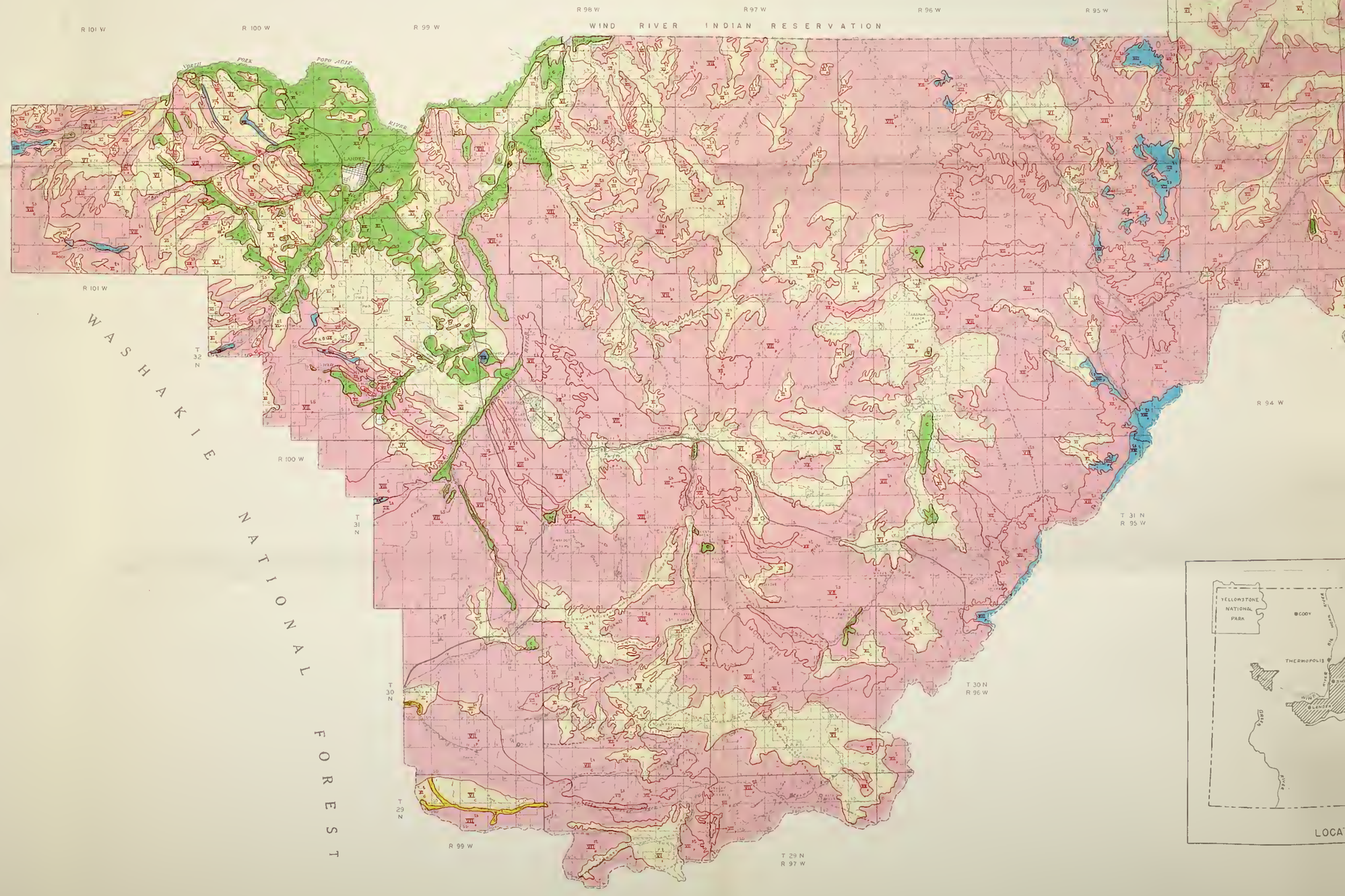
PWR—PUBLIC WATER RESERVE

CAPABILITY COLOR LEGEND

CLASS NO.

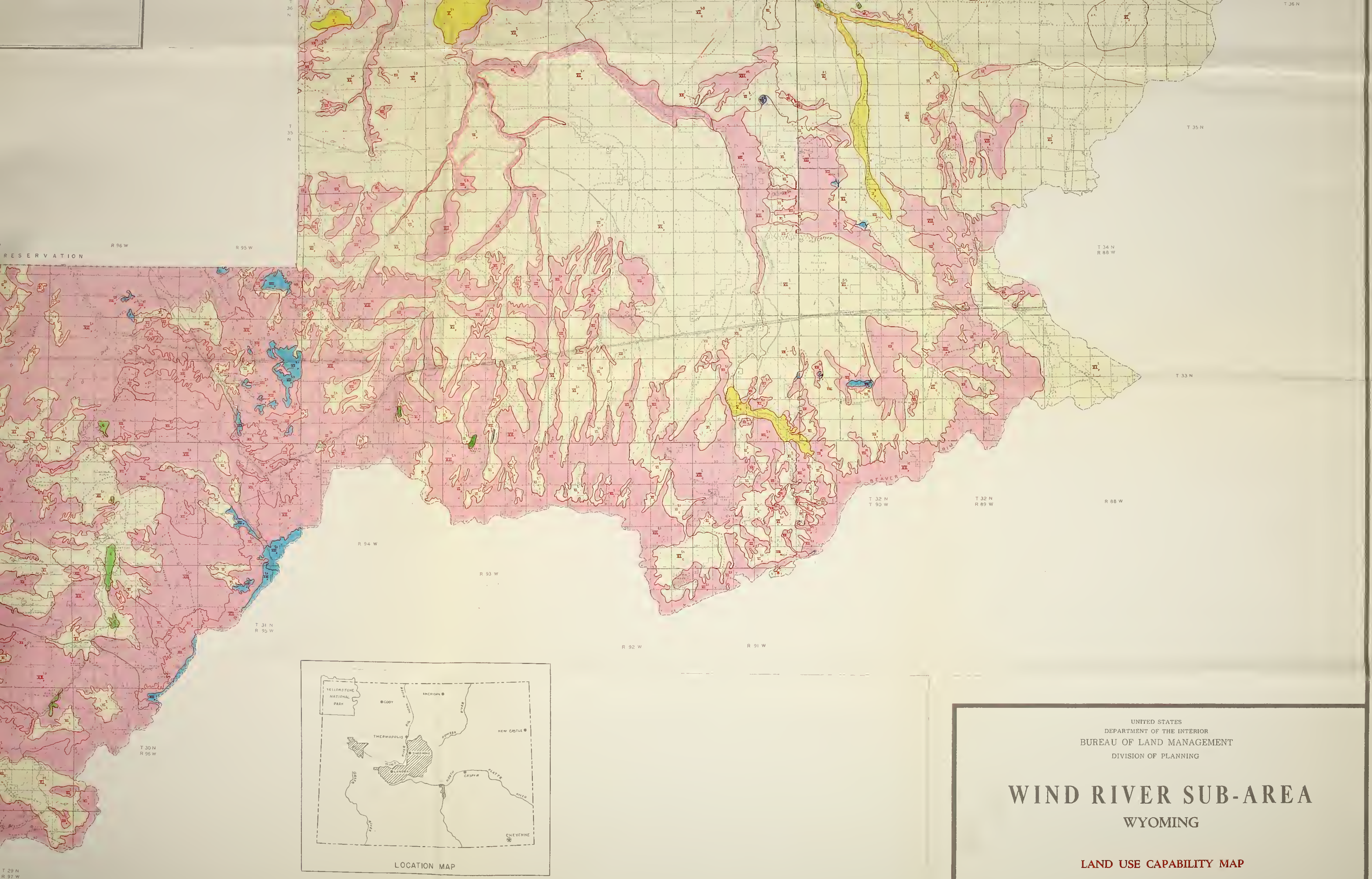
- CULTIVATION
- ARABLE LANDS: I, II, III, IV
- GRAZING LANDS: V, VI, VII
- WASTE OR BAD LANDS: VIII

NOTE: REFER TO TEXT FOR CLASS DEFINITIONS



LOCA

BRADFORD-ROBINSON PRINTING CO.



UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
DIVISION OF PLANNING

WIND RIVER SUB-AREA

WYOMING

LAND USE CAPABILITY MAP

MISSOURI RIVER BASIN INVESTIGATION
BILLINGS, MONTANA
MARCH 1949

BILLINGS DRAFTING OFFICE

MAP NO. 3 OF 5

LEGEND

BOUNDARIES

- COUNTY
- RESERVATION

WORKS AND STRUCTURES

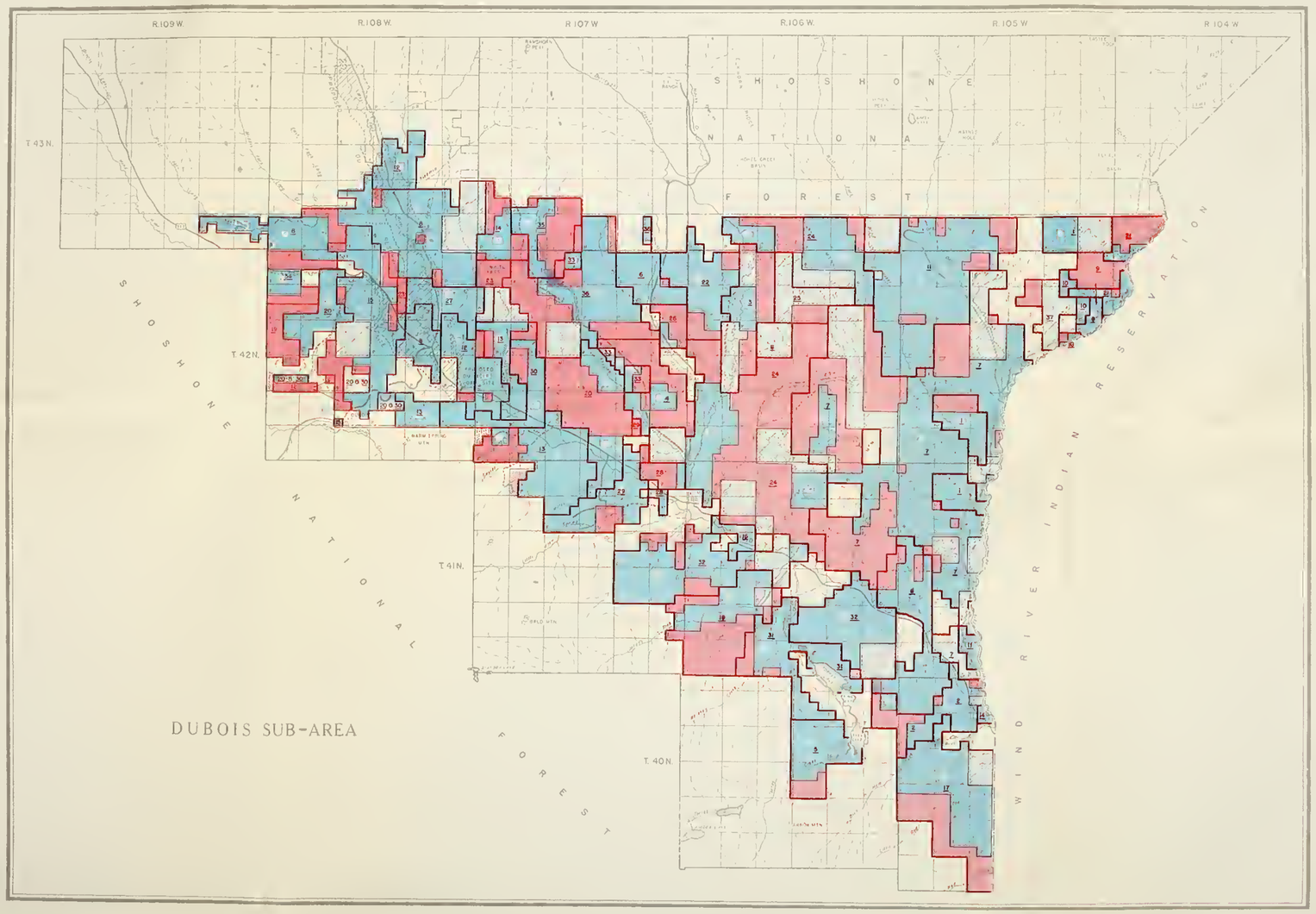
- HARD SURFACED ROAD
- GRAVELED ROAD
- IMPROVED DIRT ROAD
- UNIMPROVED DIRT ROAD
- TOWNS
- HOUSE — ABANDONED
- SCHOOL
- POWER PLANT
- CEMETERY
- MINE — ABANDONED
- OIL OR GAS WELL
- WATER WELL
- ARTESIAN WELL
- CORRAL
- LANDING FIELD
- WINDMILL
- SPRING — DEVELOPED
- RESERVOIR
- CHECK DAM
- CANAL
- CROPLAND
- CATTLE GUARD
- BARRIER
- RE 100 A — RESEEDING
- FIRE TOOL CACHE
- DESILTING BASIN
- CONTOUR FURROWING
- RAILROAD FENCED
- WATER SPREADING
- FENCE
- POWER TRANSMISSION LINE
- PIPE LINE
- RAILROAD
- TELEPHONE LINE

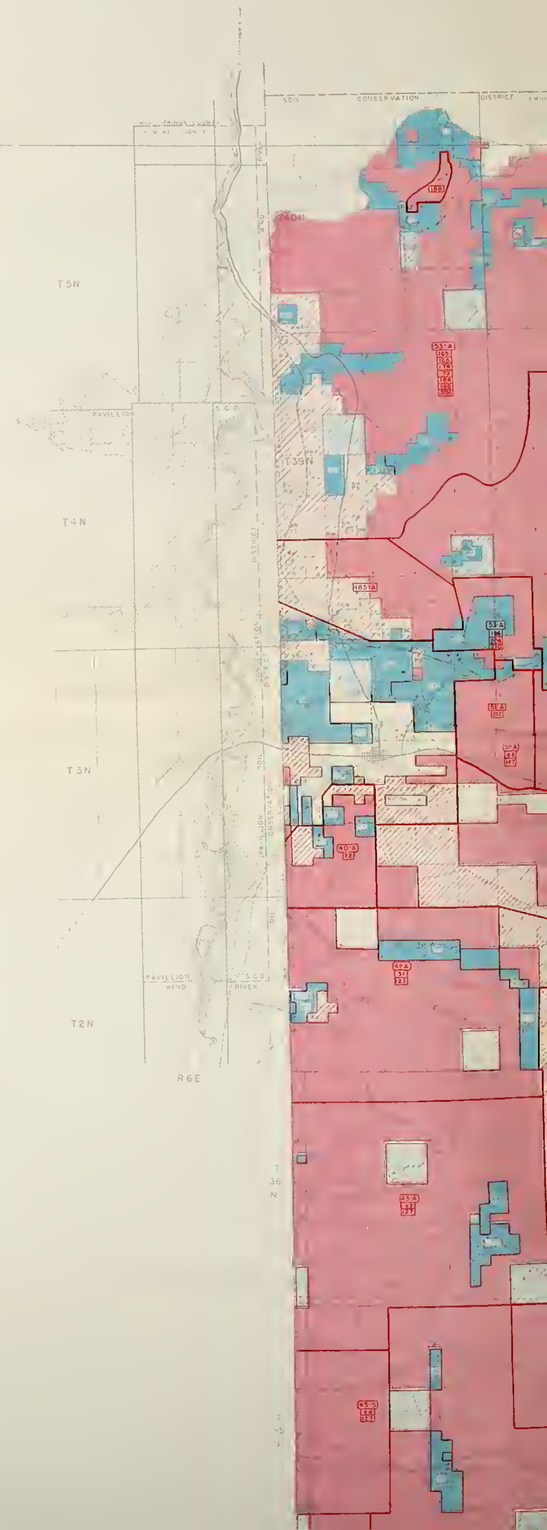
DRAINAGE

- STREAMS
- INTERMITTENT STREAM
- RIVER
- LAKE
- PROPOSED RESERVOIR

STATUS

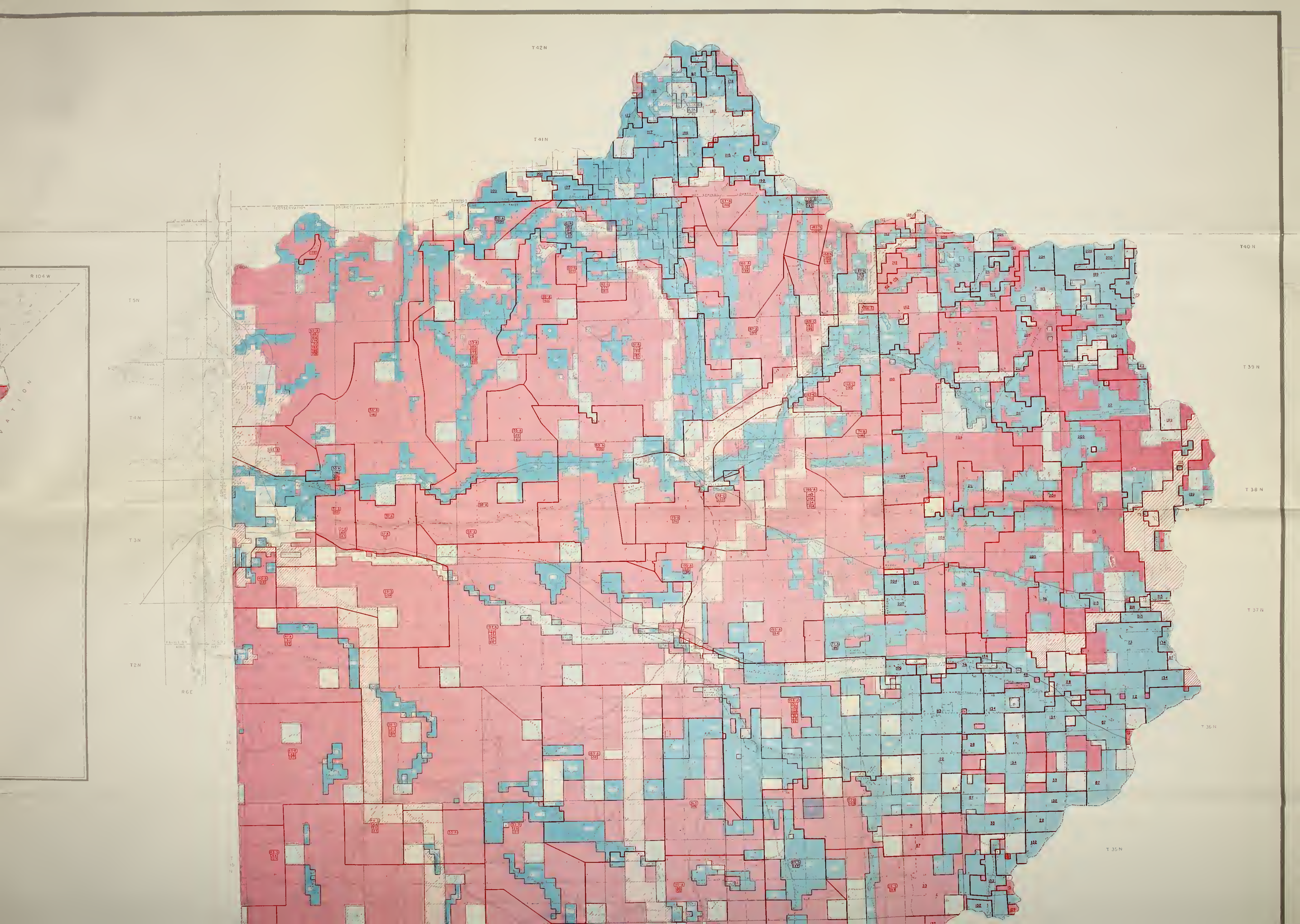
- S—STATE
- V VACANT
- P—PRIVATE
- PS—POWER SITE
- RW RECLAMATION WITHDRAWAL
- PWR—PUBLIC WATER RESERVE





LAND TENURE COLOR LEGEND

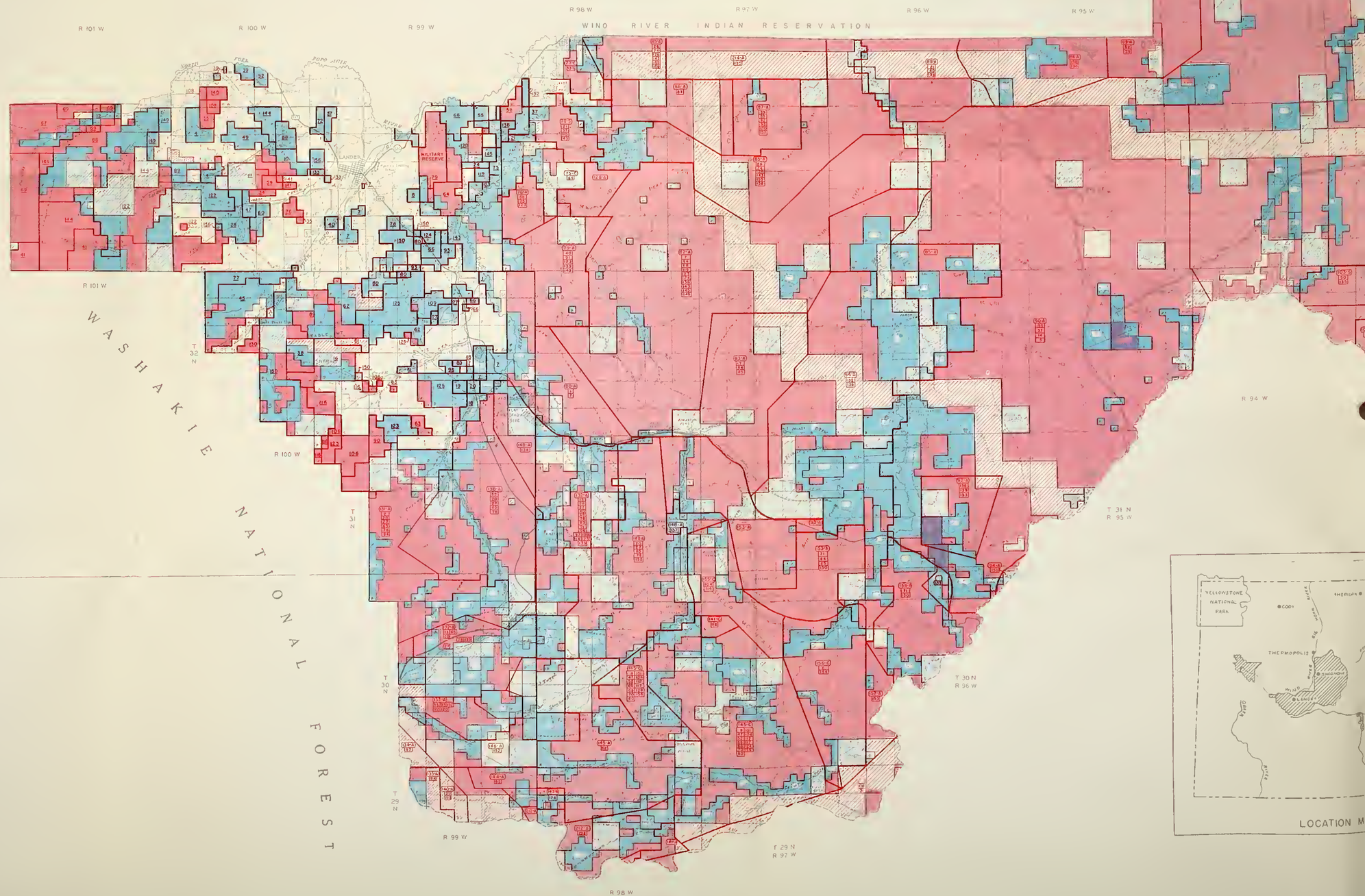
WITHIN GRAZING DISTRICT		OUTSIDE GRAZING DISTRICT
INDEX REFERENCE OF FEDERAL RANGE USERS	10 / 14	(NOT APPLICABLE)
(NOT APPLICABLE)	22	INDEX REFERENCE OF LESSEE OF PUBLIC DOMAIN
ALLOTMENT NUMBER	36-A	(NOT APPLICABLE)
ALLOTMENT BOUNDARY		OPERATING UNIT BOUNDARY LINE
BOUNDARY OF BASE PROPERTY		BOUNDARY OF PROPERTY OWNED OR CONTROLLED BY LESSEE OF PUBLIC DOMAIN
FEDERAL RANGE		PUBLIC DOMAIN LEASED UNDER SECTION 15 OF TAYLOR GRAZING ACT
(NOT APPLICABLE)		PUBLIC DOMAIN NOT LEASED
INDEX REFERENCE OF BASE PROPERTY (STATE)	L-101	INDEX REFFRENCE OF STATE LEASED


T 42 N
T 41 N
T 40 N
T 39 N
T 38 N
T 37 N
T 36 N
T 35 N
T 5 N
T 4 N
T 3 N
T 2 N
R 104 W
R 6 E

PWR - PUBLIC WATER RESERVE

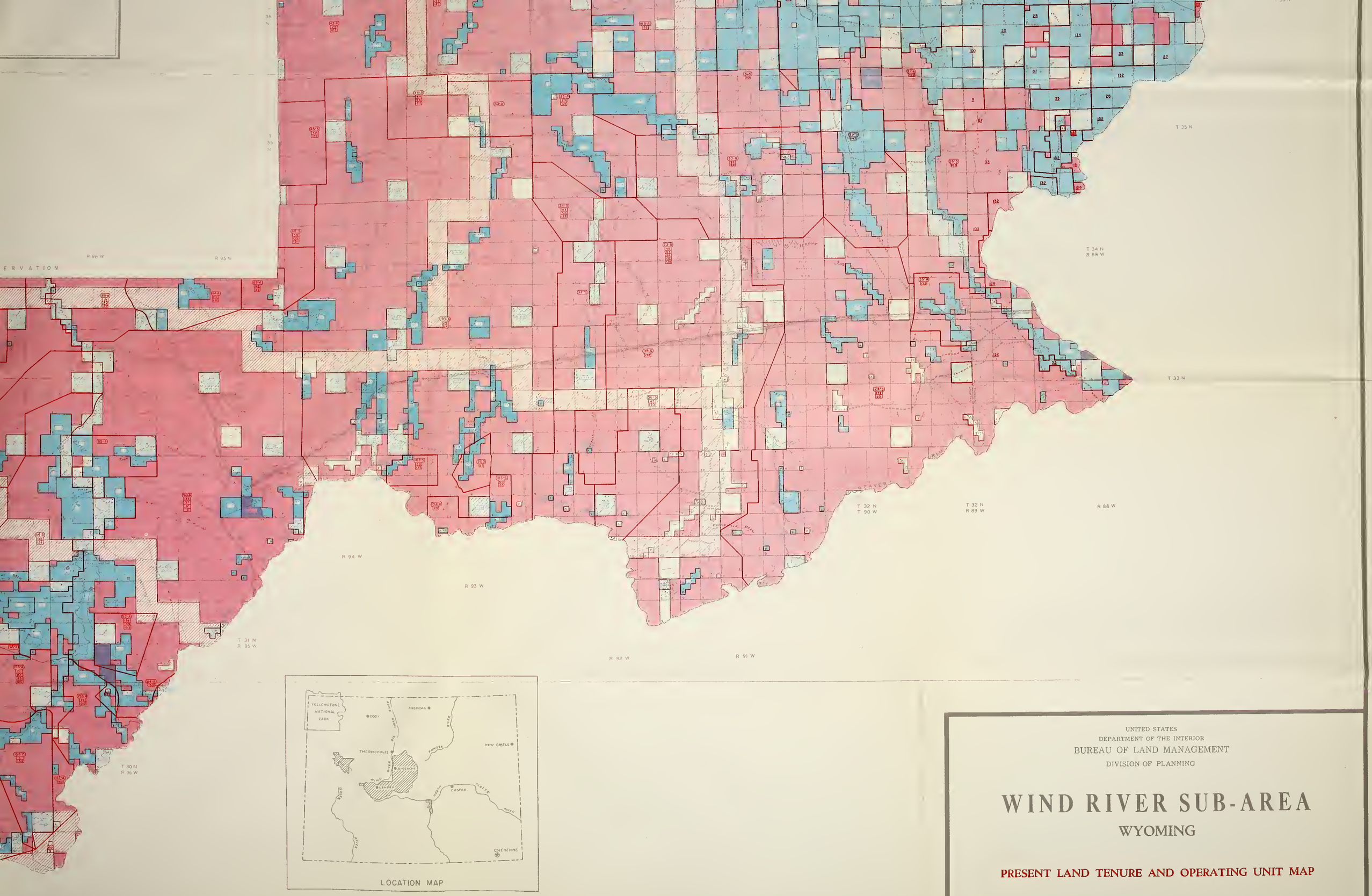
LAND TENURE COLOR LEGEND

WITHIN GRAZING DISTRICT		OUTSIDE GRAZING DISTRICT
INDEX REFERENCE OF FEDERAL RANGE USERS	10 / 14	(NOT APPLICABLE)
(NOT APPLICABLE)	22	INDEX REFERENCE OF LESSEE OF PUBLIC DOMAIN
ALLOTMENT NUMBER	36-A	(NOT APPLICABLE)
ALLOTMENT BOUNDARY		OPERATING UNIT BOUNDARY LINE
BOUNDARY OF BASE PROPERTY		BOUNDARY OF PROPERTY OWNED OR CONTROLLED BY LESSEE OF PUBLIC DOMAIN
FEDERAL RANGE		PUBLIC DOMAIN LEASED UNDER SECTION 15 OF TAYLOR GRAZING ACT
(NOT APPLICABLE)		PUBLIC DOMAIN NOT LEASED
INDEX REFERENCE OF BASE PROPERTY (STATE)	11-107	INDEX REFERENCE OF STATE LEASED
BASE PROPERTY (PRIVATE OWNED)	10	INDEX REFERENCE OF PRIVATE OWNED
BASE PROPERTY (PRIVATE LEASED)	11-1	INDEX REFERENCE OF (PRIVATE LEASED)
LANDS NOT CONTROLLED BY FEDERAL RANGE USERS	UNCLOSED	LAND NOT CONTROLLED BY LESSEES OF PUBLIC DOMAIN
PUBLIC LAND WITHDRAWALS		PUBLIC LAND WITHDRAWALS



LOCATION M

BRADFORD-ROBINSON PRINTING CO



UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
DIVISION OF PLANNING

WIND RIVER SUB-AREA

WYOMING

PRESENT LAND TENURE AND OPERATING UNIT MAP

MISSOURI RIVER BASIN INVESTIGATION
BILLINGS, MONTANA
MARCH 1949

BILLINGS DRAFTING OFFICE

LEGEND

BOUNDARIES

- COUNTY
- RESERVATION

WORKS AND STRUCTURES

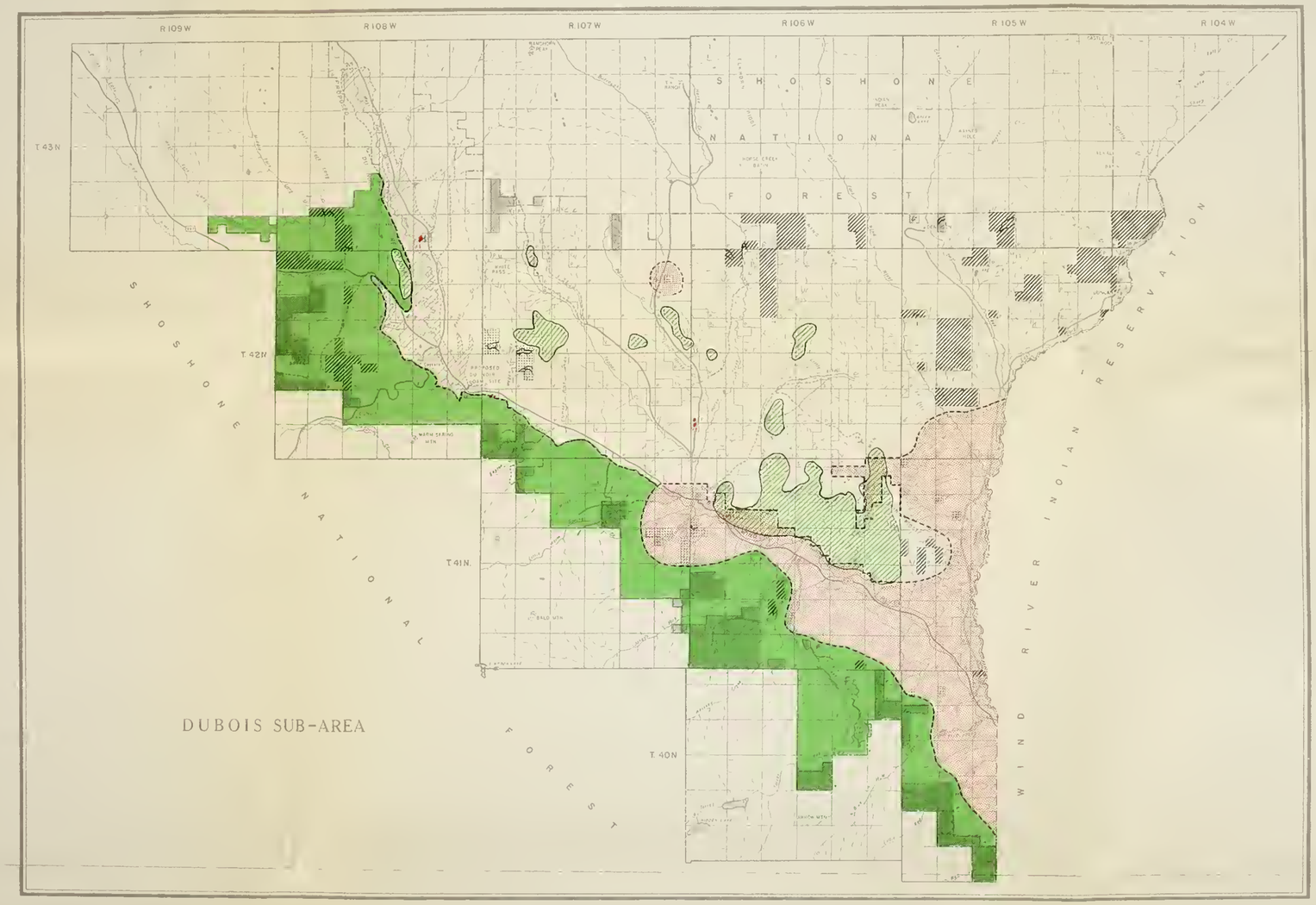
- HARD SURFACED ROAD
- GRAVELED ROAD
- IMPROVED DIRT ROAD
- UNIMPROVED DIRT ROAD
- TOWNS
- HOUSE — ABANDONED
- SCHOOL
- POWER PLANT
- CEMETERY
- MINE — ABANDONED
- OIL OR GAS WELL
- WATER WELL
- ARTESIAN WELL
- CORRAL
- LANDING FIELD
- WINDMILL
- SPRING — DEVELOPED
- RESERVOIR
- CHECK DAM
- CANAL
- CROPLAND
- CATTLE GUARD
- BARRIER
- RE 100 A — RESEEDING
- FIRE TOOL CACHE
- DESILTING BASIN
- CONTOUR FURROWING
- RAILROAD FENCED
- WATER SPREADING
- FENCE
- POWER TRANSMISSION LINE
- PIPE LINE
- RAILROAD
- TELEPHONE LINE

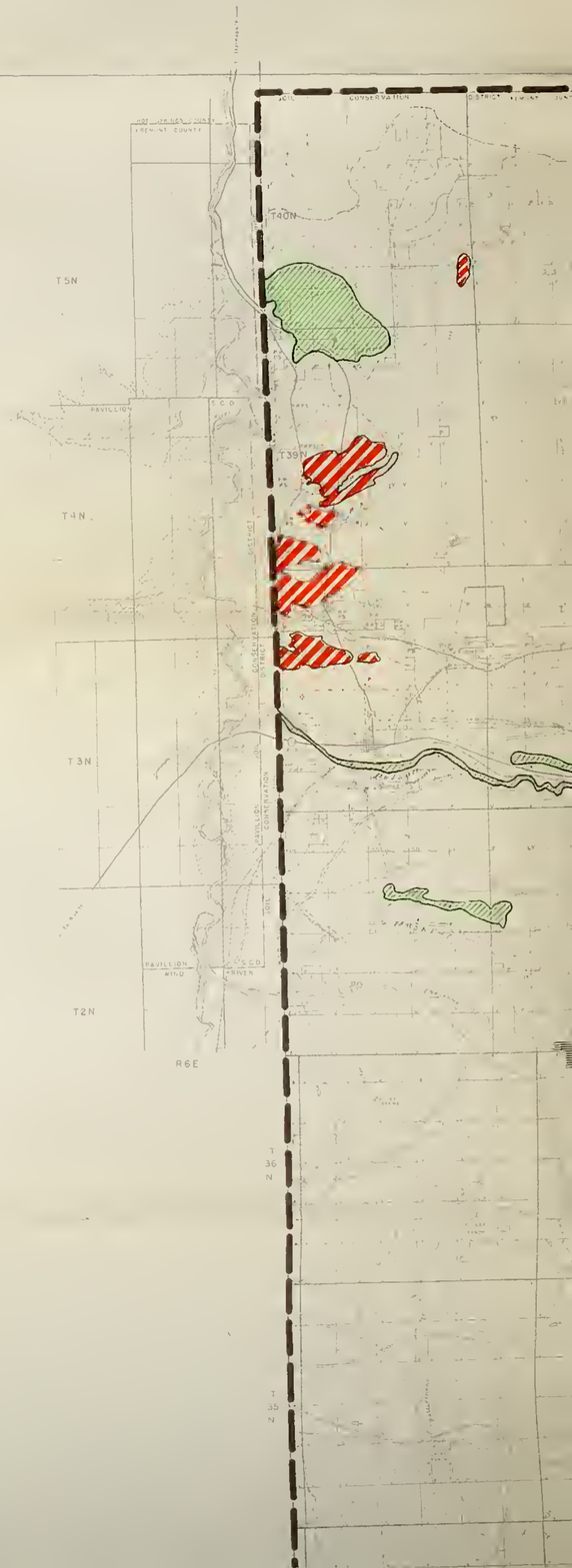
DRAINAGE

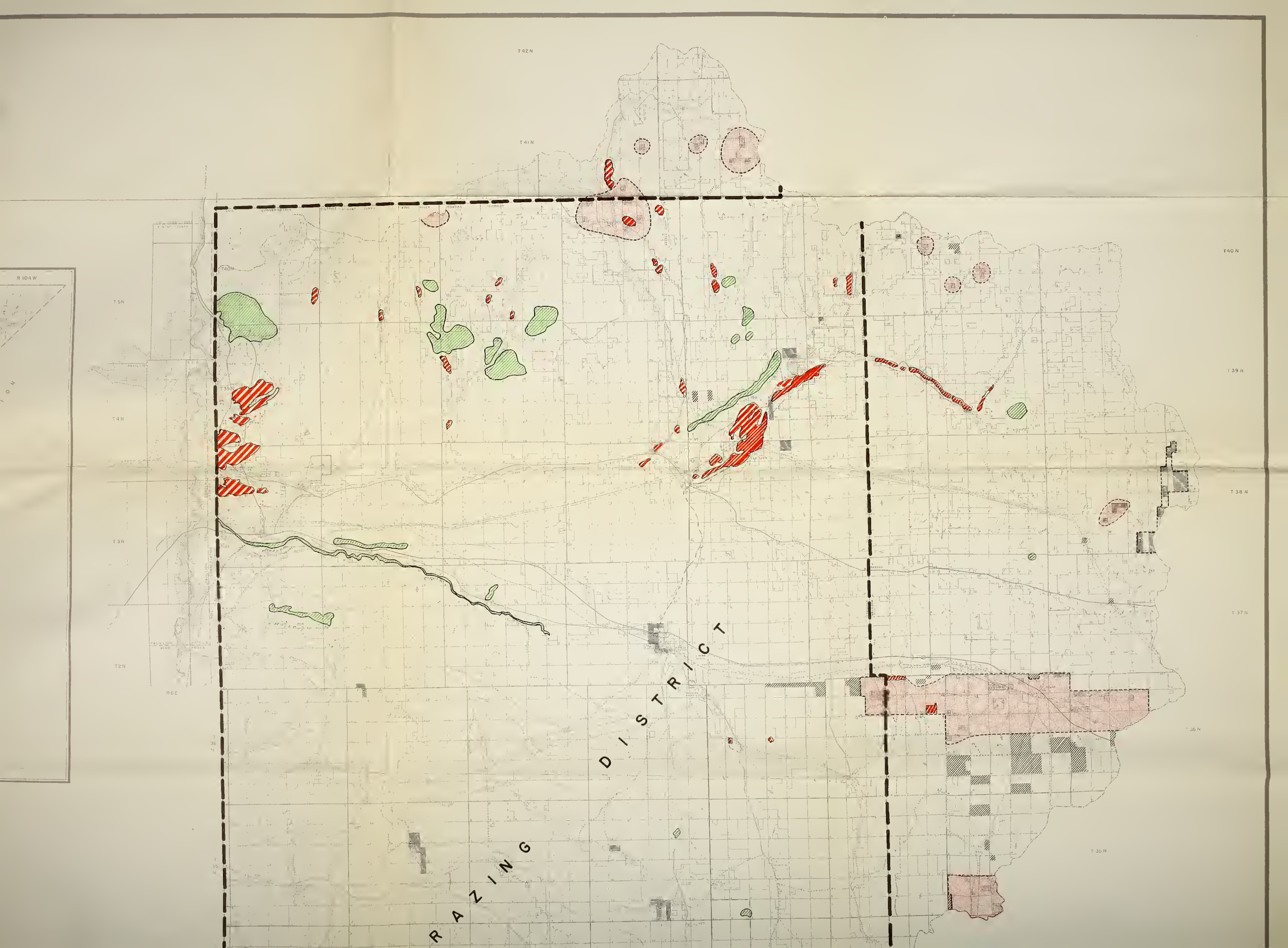
- STREAMS
- INTERMITTENT STREAM
- RIVER
- LAKE
- PROPOSED RESERVOIR

STATUS

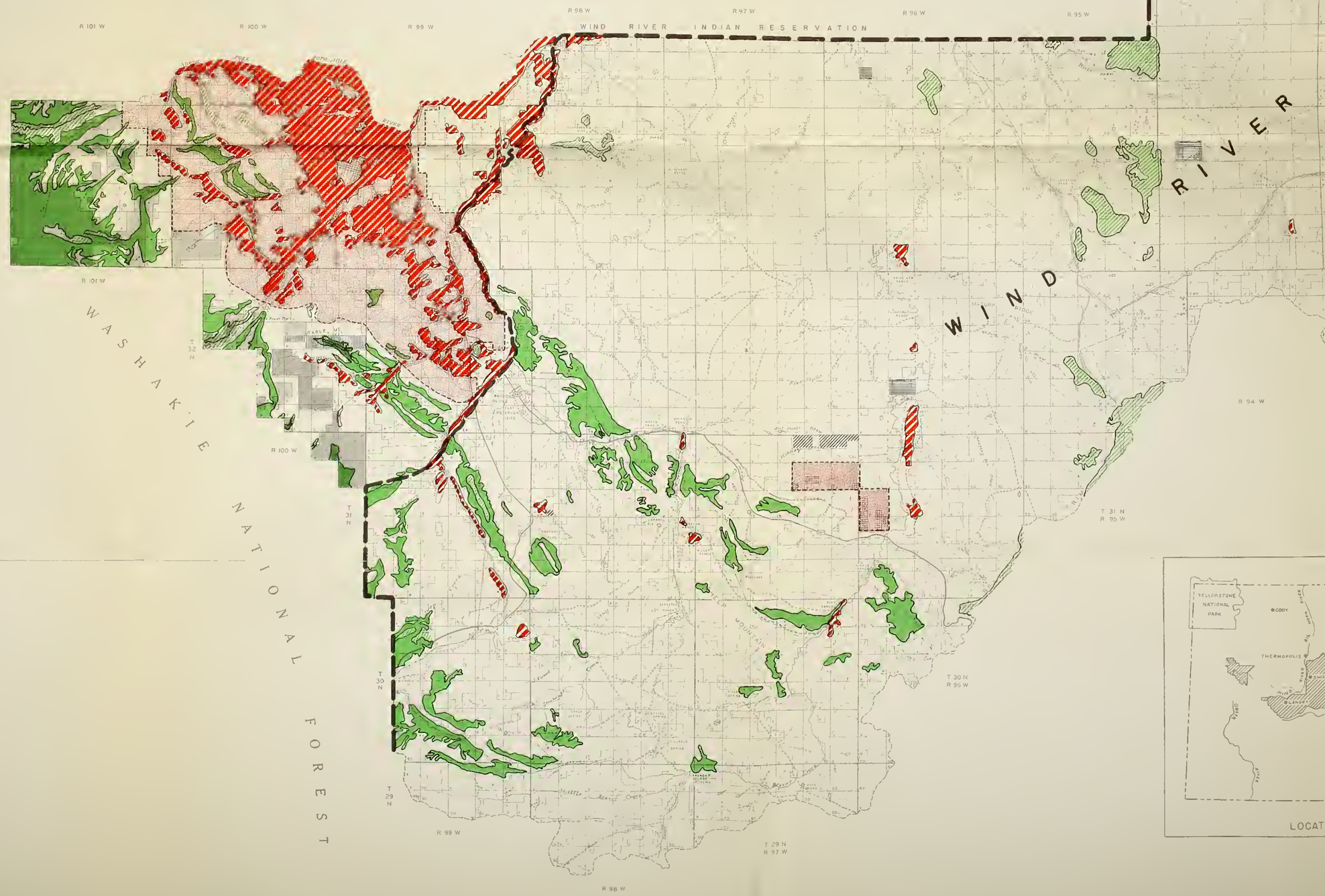
- S—STATE
- V—VACANT
- P—PRIVATE
- PS POWER SITE
- RW—RECLAMATION WITHDRAWAL
- PWR—PUBLIC WATER RESERVE






T42N
T41N
T40N
T39N
T38N
T37N
T36N
T35N
T5N
T4N
T3N
T2N
R104W
R6E
PAVILION
WIND
RIVER
GRAZING
DISTRICT

PWR—PUBLIC WATER RESERVE



SUITABILITY

- PRIMARILY SUITABLE FOR CULTIVATION.
- PRIMARILY SUITABLE FOR FOREST AND WATERSHED.
- PRIMARILY VALUABLE FOR WATERSHED, WILDLIFE AND RECREATION.

NOTE: ALL REMAINING AREAS ARE PRIMARILY SUITABLE FOR GRAZING AND WATERSHED.

PROPOSED ADJUSTMENTS

- AREAS WHERE PUBLIC LANDS HAVE NEGLIGIBLE PUBLIC VALUES AND ARE BEST SUITED FOR PRIVATE MANAGEMENT.
- PUBLIC LANDS BEST SUITED FOR PRIVATE OWNERSHIP

REMAINING AREAS WHERE PUBLIC INTERESTS PREDOMINATE AND WHERE PUBLIC LANDS ARE BEST SUITED FOR PUBLIC MANAGEMENT.

- PUBLIC LANDS SUITED FOR MANAGEMENT UNDER STATE PROGRAMS.
- PUBLIC LANDS BEST SUITED FOR FOREST AND WATERSHED MANAGEMENT.
- ADDITIONAL LANDS NEEDED FOR PUBLIC STOCK DRIVEWAY PURPOSES.
- STOCK DRIVEWAY LANDS NOT NEEDED FOR PUBLIC STOCK DRIVEWAY PURPOSES

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UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
DIVISION OF PLANNING

WIND RIVER SUB-AREA

WYOMING

LAND-USE SUITABILITY
and
PROPOSED LAND OWNERSHIP ADJUSTMENT MAP

MISSOURI RIVER BASIN INVESTIGATION
BILLINGS, MONTANA
MARCH 1940

BILLINGS DRAFTING OFFICE

MAP NO. 5 OF 5

LEGEND

BOUNDARIES

COUNTY

RESERVATION

WORKS AND STRUCTURES

HARD SURFACED ROAD

GRAVELED ROAD

IMPROVED DIRT ROAD

UNIMPROVED DIRT ROAD

PUBLIC LANDS SUITED FOR MANAGE-

LAND TENURE COLOR LEGEND

LEGEND

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